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A New Fourteen-inch Engine Lathe.

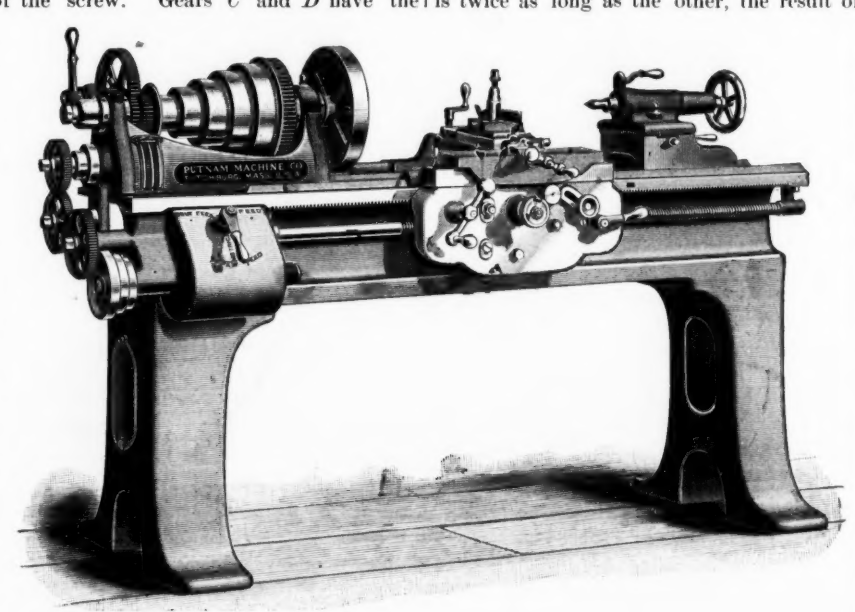
We present herewith perspective and outline engravings of a new engine lathe which has some features which we think worthy the attention of those interested in lathes, as most of our readers of course are.

As will be perceived, the lathe has a modern and symmetrical appearance, and embodies advanced ideas in construction and proportions. The cone has five steps and drives through powerful back gears, giving a regular advance in speeds from the slowest to the fastest. The spindle is exceptionally heavy, is of steel, with a $1\frac{1}{8}''$ hole through it, and has ground journals running in boxes made of a single piece of composition which are easily renewed, easily adjusted to take up wear, preserve the original alignment of the spindle so far as possible in adjusting and restore it exactly when renewed.

The carriage rests upon unusually large Vs, and has a bearing on them of $19\frac{11}{16}''$, the front V, where most of the wear comes, being much the largest. The foot-stock is secured to the bed by an eccentric clamping arrangement which holds it very securely, is simple, and requires but a single movement of the lever to fasten or release the block.

On glancing at the engraving attention will naturally be first attracted to the projection on the front of the bed below the head-stock, and this, with the mechanism within it, we will now discuss. Briefly, the object of this is to provide means of quickly changing from gear to belt feed or *vice versa*, or from the English to the metric system of screw threads, and to give a very coarse feed instantly available, all this being accomplished without changing gears, shifting of belts or stopping the lathe, but by the movement of the single lever on the hood, as indicated in the engravings. Provision is made for cutting threads from 4 to 36 per inch (including $11\frac{1}{2}$ or gas pipe thread), and by the addition of a few gears up to 64 per inch.

Referring to Fig. 2 the device is there shown with the casing broken away to show the interior arrangements, which, though at the first glance they appear somewhat complicated, are in reality quite simple. The lead screw, which comes in at the left of Fig. 2, terminates not as usual where the change gear goes on at the end of the lathe, but between the clutches A' and B'. The latter clutch with spur gear wheel of which it forms a part being keyed to the end of the screw, and held in place by the ring nut shown between these two clutches. By applying a spanner wrench to this ring nut, endwise lost motion may be taken up in the box. When clutches A' and B' are engaged by the movement of the lever, the screw is, of course, driven direct from the change gears, as for ordinary or English screw cutting; but when in the position shown by the drawing the driving is through the medium of the gear wheel A to the gear B which is part of a loose sleeve on which is also the wide-faced gear C; this gear engaging with and driving the gear D which is keyed to the end of the screw. Gears C and D have the same number of teeth, while gear A has 50 and gear B 127, proportions which give practically exact metric threads, as has been before shown in these columns. The shaft a carries at its left hand end the lower feed pulley, and is driven by the feed belt in the usual manner. Pinned to this shaft is the clutch B', and when clutch A'' is engaged with this the screw is driven by the belt through the medium of these clutches and gears C and D.



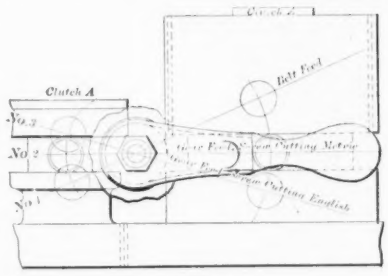


Fig. 4.

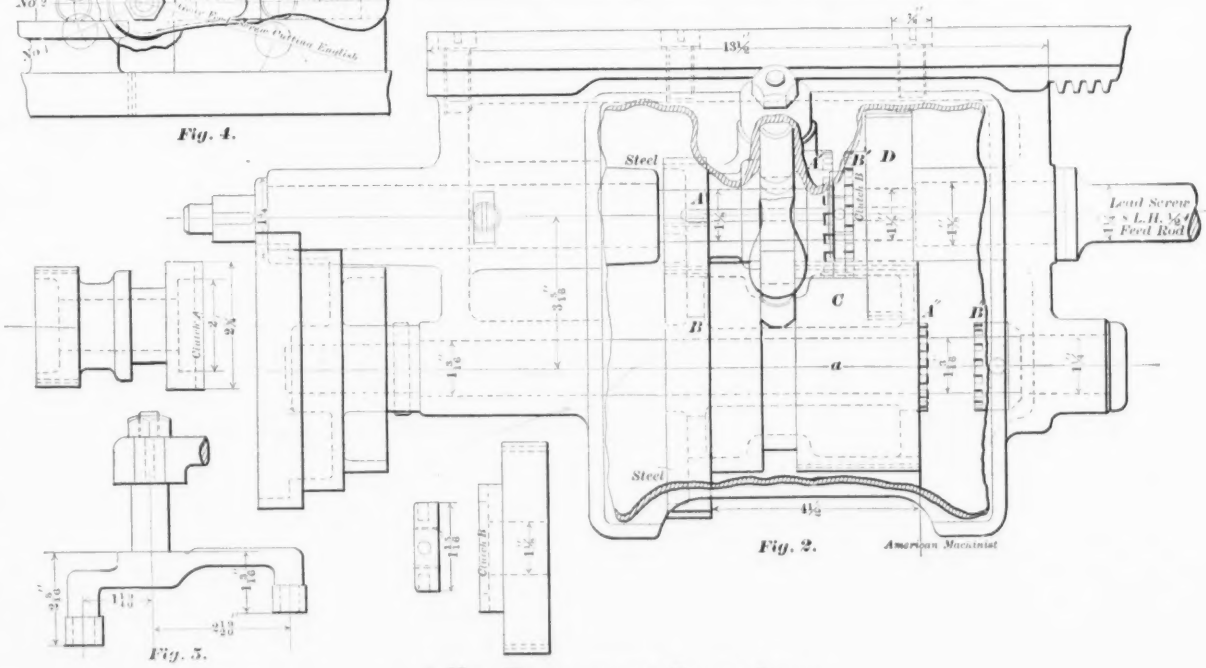


Fig. 2.

Fig. 3.

A New Fourteen-inch Engine Lathe.

The means by which these various clutches are thrown in and out are shown by Figs. 3, 4 and 5—Fig. 3 being an end view of the mechanism in place, Fig. 4 a diagram showing the motions of the lever, and Fig. 5 the double lever provided with rollers which engage with the grooves in the two sleeves, to which clutches A' and A'' are attached. It will be noticed that one arm of this lever is twice as long as the other, the result of this being that the lower sleeve with its gears and clutch moves twice as far as the upper sleeve and gears by the same movement of the lever, both sleeves always moving when the lever is moved, but in opposite directions. Supposing the lever to be in position No. 1 as indicated in Fig. 4 for the belt feed, clutches A'' and B', Fig. 2, will then be engaged, and gears A and B disengaged, gears A and D not being disengaged because of the extra width of face of A. In the position No. 2 for metric threads neither clutch is engaged, and the driving is through the gears, as before explained. In position 3, for English screws, both pairs of gears are disengaged, and the driving is through the clutches A' and B'. Of course either the screw or the friction feed can be used as desired, independent of the manner of giving motion to the screw, and thus a great variety of feeds are readily obtainable, the friction feed being driven by means of a sleeve which is splined to the screw, and carries a bevel gear for giving motion to the feed train, as shown at Figs. 6 and 7, which illustrate the carriage mechanism.

Fig. 7 is a view looking from the back of the lathe toward the front, these drawings being used in the shops for lathes having the main crank handle either at the left or right of the carriage, both styles being made. The principal new feature in this part of the lathe is in the device for throwing the rack pinion out of gear when the nut is closed, and *vice versa*, this being done by the same movement that opens or closes the nut. At the lower part of the carriage apron, Fig. 7, is seen the lever L, which is pivoted in the center, its left-hand extremity engaging with a projection formed on the lower part of the lead screw nut. The opposite end of the lever engages with a sliding plate, in which the rack pinion is journaled so that, as the lower part of the nut rises in closing, the slide falls and the pinion is disengaged, to be again engaged when the nut is opened. This matter thus takes care of itself, and is a feature which is certain to be always used because it must be, and where the carriage is to be run back by hand, as is often done with moderately long screws, the crank handle is ready for use as soon as the nut is opened, without the necessity for stopping to put the pinion in place.

At the extreme left of Fig. 7 is seen a vertical lever which is on the same shaft as the main crank handle, but is inside the apron. A portion of the inside of this lever where it fits over a sleeve is formed into a cam as shown, so that when the lever is turned part way around it presses a loose key firmly onto the shaft, and thus locks the carriage for the use of the automatic cross-feed. Both the carriage and the cross-feeds are reversed by means of the knurled knob at the left in the perspective view, the mechanism for this being shown in Fig. 7. The value of these special features for many kinds of work will of course be appreciated by every practical lathesman, the different rates of feed being useful whether metric threads are cut or not.

The lathe is made with beds 5, 6, 7 and 8 feet long, by the Putnam Machine Co., Fitchburg, Mass.

Experiments with Throttling Steam Calorimeters.

By WILLIAM KENT, M. E.

During two boiler tests recently made by the writer, an opportunity was afforded of making comparative tests of the moisture in the steam by the use of two different forms of throttling calorimeters, the Barrus and the Heisler. These instruments are described in the Transactions of the American Society of Mechanical Engineers, vols. xi and xii. They are alike in principle, which consists in taking a sample of steam out of the main steam pipe near to the boiler through a ½-inch pipe perforated with a number of small holes, throttling it by passing it through an orifice about ⅛ inch diameter, and allowing it to escape at atmospheric pressure. If there is no loss by radiation, all the heat in the steam previous to throttling should be found in the throttled steam, raising its temperature or superheating it to a point considerably above 212° if the original steam be dry. The greater the amount of moisture in the original steam the nearer the temperature approaches 212°, reaching it when the percentage of moisture becomes from 3 to 4 per cent., the maximum capacity of the instrument. From the observed data of steam pressures and temperatures, the per cent. of moisture in the steam may be calculated by a suitable formula, such as is hereafter given. For the purpose of separating the excess of water, if the moisture is greater than or approximates to the capacity of the instrument, the Barrus calorimeter is provided with a small steam separator, called a "drip box," which may or may not be used in connection with the throttling instrument, called the "heat gauge," according as the steam to be tested is more or less moist.

FIRST SERIES OF TESTS.

In the first of the experiments herein referred to, as it was uncertain whether or not the moisture in the steam would at any period of the test exceed the capacity of the heat gauge, the drip box was used, with the Barrus calorimeter. The Heisler calorimeter is not provided with a separator. In this test the boiler was of the water-tube type, of 240 horse-power, builders' rating, the water and steam drums being horizontal, 36 inches diameter, and the water level carried near the middle of the drum. The boiler was driven a little above its rating. The perforated pipe crossing the whole diameter of the main steam pipe was connected with a ½-inch steam pipe about 5 or 6 feet long, provided with a cross, to which, by means of short nipples, were attached the calorimeters. The pipe was longer than it is customary to use in connection with these calorimeters, but complication of steam piping in the space above the boilers rendered it necessary. The piping and the Barrus calorimeter were well covered with hair felt, but the Heisler calorimeter was left exposed, so as to determine, if possible, what was the effect of radiation on the instrument.

The calculations from the observed data were made by the use of a modification of Professor Peabody's formula (devised by the writer), as follows: Let H = total heat, and L = latent heat of steam due to the pressure in the main pipe, h = total heat due the pressure in the discharge side of the calorimeter, = 1146.6 at atmospheric pressure, K = specific heat of steam, T = temperature of the throttled and superheated steam in the calorimeter, t = temperature due the pressure in the calorimeter, = 212 at atmospheric pressure, w = per cent. of heat moisture in the steam.

Then $$w = 100 \times \frac{H - h - K(T - t)}{L}.$$

This formula is believed to be rather simpler in form than those given by other writers.

The following are the observed data, and the results of the calculations. K is taken at 0.48.

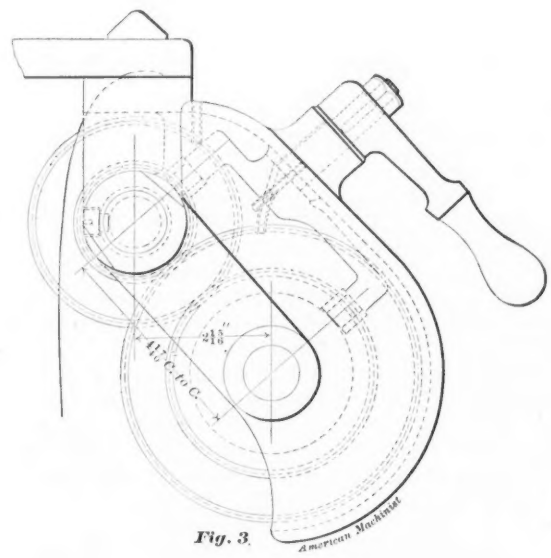


Fig. 3.

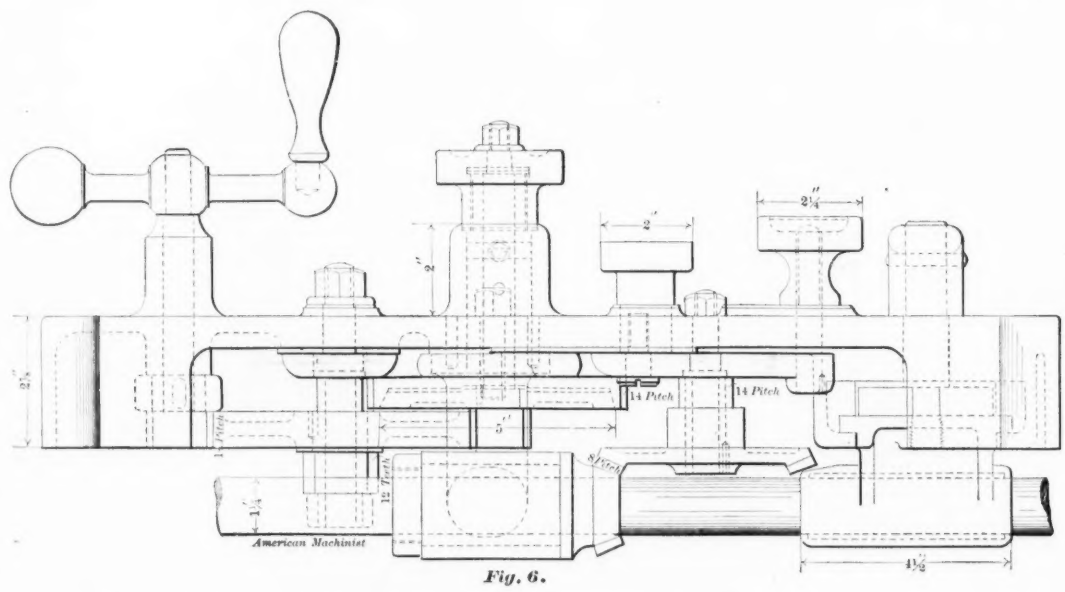


Fig. 6.

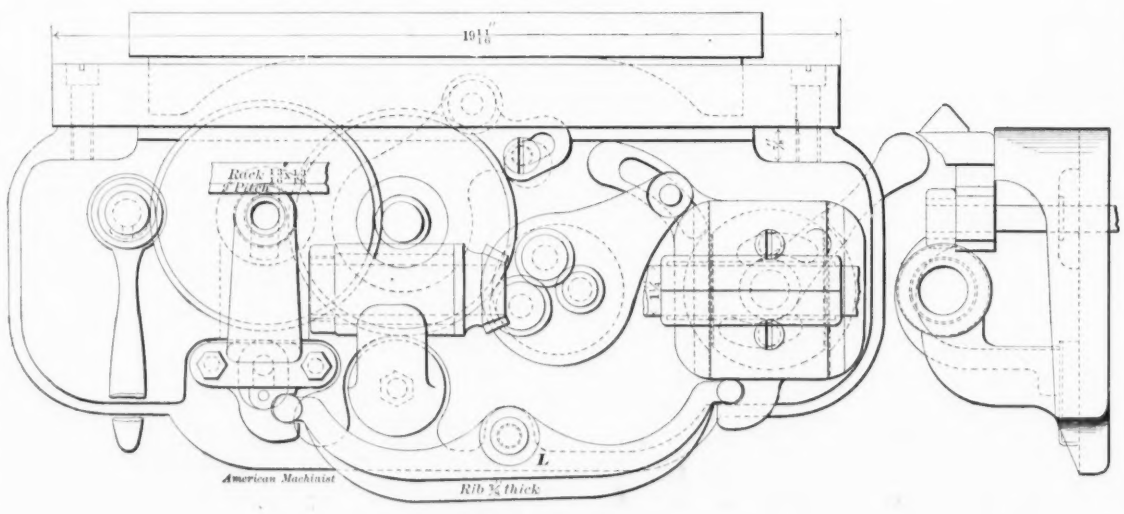


Fig. 7.

FOURTEEN-INCH LATHE.—SEE PAGE 1.

No. of Test.	Gauge Pressure. Lbs.	H.	L.	T − t Barrus.	T − t Heisler.	Calculated per Cent. Moisture Barrus.	Calculated per Cent. Moisture Heisler.
1	116	1188.0	868.3	51	57	1.94	1.61
2	114	1187.6	869.2	36	62	2.63	1.21
3	114	1187.6	869.2	45	62	2.20	1.18
4	116	1188.0	868.3	43	63	2.39	1.29
5	116	1188.0	868.3	41	63	2.50	1.29
6	118	1188.8	867.5	36	63	2.81	1.32
7	114	1187.6	869.2	55	63	1.68	1.24
8	113	1187.4	869.6	53	63	1.77	1.22
9	113	1187.4	869.6	56	61	1.60	1.32
10	113	1187.4	869.6	66	59	1.04	1.44

Average of first nine tests 46.2, 61.7, 2.17, 1.31.
Average of nine Barrus tests after deducting 1.04, taken as the moisture due to radiation, 1.13.

The first nine observations were made at intervals of about fifteen minutes apart, while the boiler was in regular service. The average of the calculated results shows 2.17 per cent. moisture by the Barrus calorimeter and 1.31 per cent. by the Heisler.

As Mr. Barrus, in describing the operation of his instrument, advises that the results obtained by it be corrected for radiation by means of a test made with it when no steam is flowing from the boiler through the main pipe, as when the stop valve of the main pipe or of the engine is shut, observations were made at the end of the boiler test by continuous readings during five minutes or more, beginning just before the doors were opened to draw the fires at the end of the test, and ending when the grates were quite clean and cold; air was rushing through the boiler. The figures given in the 8th line are those found at the beginning of this period; the figures in the 10th line those found at the end, and the figures in the 9th line were found about the middle of this period. During this period the thermometer in the Barrus calorimeter rose from 265 to 278, and the thermometer in the Heisler calorimeter fell from 275 to 271, the calculated percentage of moisture falling in the Barrus from 1.77 to 1.04, and the Heisler rising from 1.22 to 1.44.

According to Mr. Barrus' directions, the 1.04 per cent. found at the end of the period, when no steam could have been flowing out of the boiler (except the trifling amount passing through the calorimeter) represents a correction due to radiation from the piping and the instrument, to be subtracted from the average results of the tests, thereby reducing the calculated average percentage of moisture from 2.17 to 1.13. Since the pipe leading to the instrument was rather long, and the drip box of the Barrus calorimeter exposed a considerable surface to radiation, it is quite likely that some correction of this kind for the effect of radiation is necessary, although it is a matter of doubt (as stated by Professor Carpenter, Trans. A. S. M. E., Vol. XII, page 871) whether the steam flowing at a very small velocity in the main pipe under these conditions is actually dry, as Mr. Barrus supposes. If this steam was dry, or to any extent drier at this time than it was during the regular operation of the boiler, the question arises, why did not the temperature in the Heisler calorimeter rise also, as it did in the Barrus, instead of falling, as it actually did? The writer can find no explanation of this singular phenomenon, and must wait for further observations under similar circumstances to throw light upon it.

These results agree very closely with the results of numerous tests the writer has made by a condensing coil calorimeter of the moisture in the steam made by this same type of boiler, which have generally ranged between 1 and 1½ per cent.

SECOND SERIES OF TESTS.

The second series of experiments was made during the test of a Root water-tube boiler of 287 horse-power. The water drums of this boiler were horizontal, seven in number, 14½ inches in diameter, and the water level was carried about 4 inches above the bottom of the drums. The boiler was driven very steadily at the rate of about 306 horse-power, or about 3 per cent. above its rating.

The perforated pipe for sampling them was inserted in the main steam pipe close to the steam drum. About 9 inches from the steam pipe on the ½-inch pipe leading to the calorimeters there was placed a Y branch, one leg leading by a piece of pipe 6 inches long to the Heisler calorimeter, and the other by a similar piece of pipe to the Barrus. The drip box of the Barrus calorimeter was not used in this case. Both calorimeters and the pipes leading to them were thoroughly felted, and the conditions under which each instrument was used were in all respects identical. Readings of the thermometer were made about every fifteen minutes, and after a reading had been taken the thermometers were interchanged, so eliminating the error of the thermometers. There was an average difference between the readings of the two thermometers of five degrees at 275 F., which was afterwards found to be due to an error of plus two degrees in one thermometer, and minus 3 degrees in the other. Both of the thermometers were made by well-known makers, with name and number enameled on them. One of them, the one with the plus error of two degrees, was purchased only two days before the test, costing $3, and guaranteed by its maker to be accurate. This same thermometer had an error of five degrees at 212, reading 217 in boiling water. Cheaper thermometers, costing $1.50, were found much more accurate. None of the thermometers had a uniform bore, the error varying irregularly at different parts of the scale. This statement concerning the errors of the thermometers is made to call attention to the necessity of having the thermometers used in a calorimeter test standardized for the temperatures at which they are to be used, if great accuracy is desired. An error of five

degrees in the thermometer makes an error of about 0.25 in the apparent percentage of moisture in the steam. The steam gauge used for determining the pressure of the steam during the tests was placed on a siphon pipe attached to the steam drum in sight of the calorimeter. By comparison with corrected readings of a thermometer in the steam pipe it was found to have an error of minus two pounds.

Twenty-two observations were made with each calorimeter, at steam pressures ranging from 67.5 to 77.5. For the purpose of making the comparison of the results as clear as possible, they are arranged as in the table below; first, showing the average results of all the tests at four different pressures; second, three tests by the Barrus calorimeter showing maximum and three minimum moistures at different pressures; and third, three tests showing maximum and minimum moisture by the Heisler.

COMPARISON OF BARRUS AND HEISLER CALORIMETERS.

1.—AVERAGE OF ALL TESTS AT DIFFERENT TEMPERATURES.

Steam Pressure.	H.	L	T. 212.	Per Cent. Moisture.
67.5	1177.7	893.8	58	0.37
72.	1178.8	890.1	63	0.22
75.	1179.6	888.4	66	0.15
77.5	1180.1	886.9	69	0.05
Average moisture in all Barrus tests				0.19
Average moisture in all Heisler tests				0.20

2.—TESTS WITH BARRUS CALORIMETER

a. Showing maximum moisture.

67.5	1177.7	892.8	54	0.57
72.5	1179.	889.8	62	0.29
77.5	1180.1	886.9	64	0.32

b. Showing minimum moisture.

70.	1178.3	891.3	62	0.21
75.	1179.6	888.4	68	0.05
77.5	1180.1	886.9	70	−0.01

3.—TESTS WITH HEISLER CALORIMETER.

c. Showing maximum moisture.

72.5	1179.0	889.8	62	0.29
75.	1179.6	888.4	64	0.26
77.5	1180.1	886.9	68	0.10

d. Showing minimum moisture.

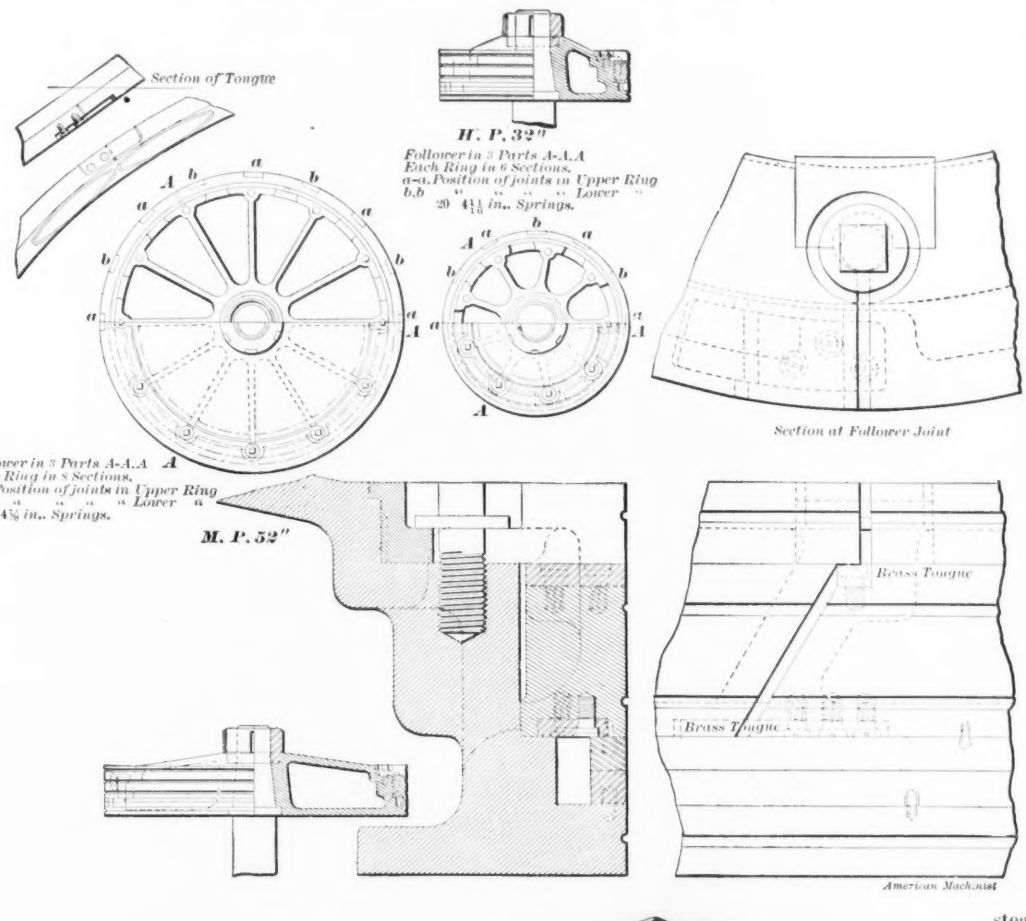
69.	1178.1	891.9	64	0.09
74.	1179.3	889.0	66	0.11
76.	1179.8	887.8	68	0.07

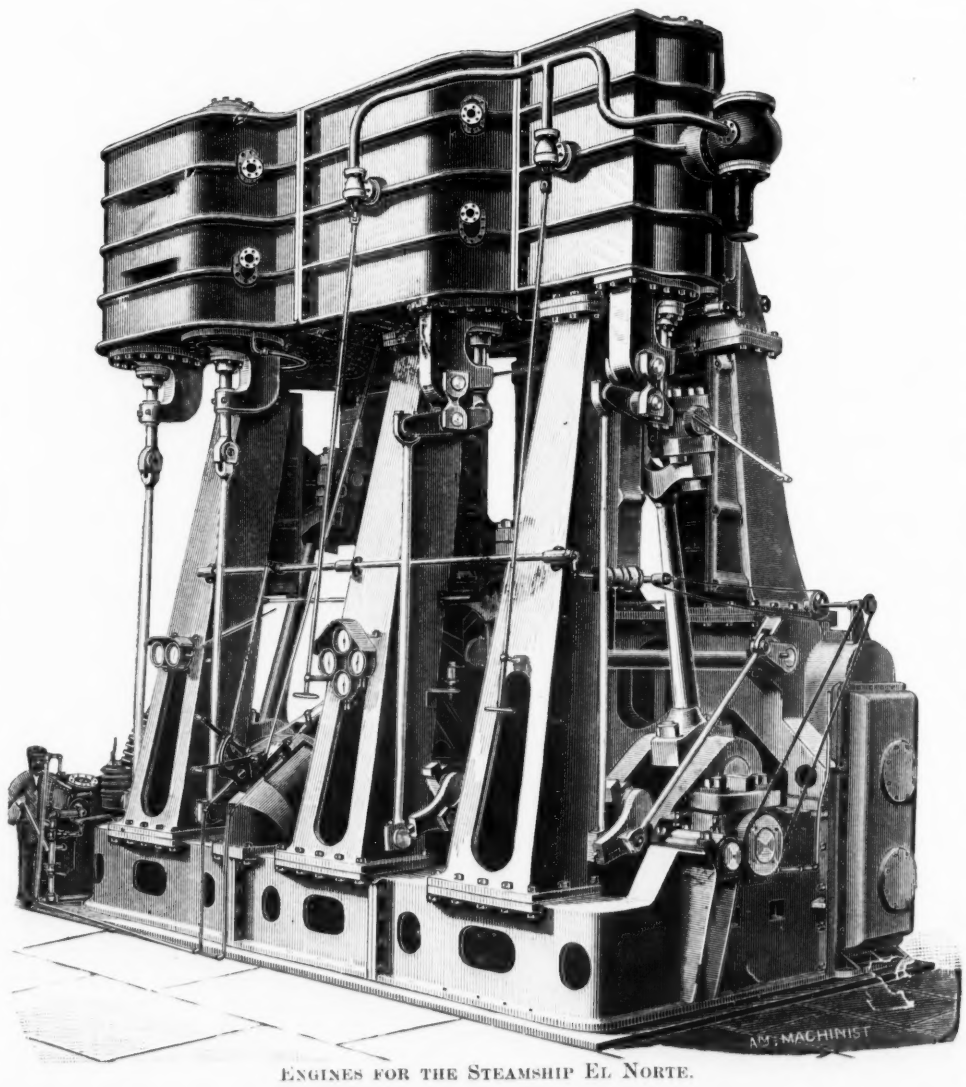
The highest apparent percentage of moisture found at any time was 0.57 and the lowest—0.01, the minus sign indicating a slight superheating, which is improbable, as no superheating was at any time shown by the thermometer in the steam pipe. The average of all the results by the Barrus calorimeter, without any correction for radiation being made, was 0.19, while the average by the Heisler calorimeter was 0.20. The maximum difference at any time observed between the corrected readings of the thermometers in the Barrus and the Heisler calorimeters was 4°, which would represent 0.21 per cent. moisture, but the average difference was only 0.3°, representing only about .015 per cent. moisture. The two instruments therefore give practically identical results.

The necessity of making a correction for radiation in these tests is not apparent. If we take the six tests showing minimum moisture from the above table they give an average of only 0.10 moisture. The thermometer in the steam pipe showing no superheating at any time during these tests, the maximum possible correction for radiation, even if the steam should be absolutely dry, could not be over 0.10 moisture, corresponding to a difference in reading of the thermometer of only 2 degrees.

There is a possible error in the calculated results due to the uncertainty as to whether or not 0.48 is the correct value for the specific heat of superheated steam. Mr. Barrus considers it to be about 0.42 for temperature above 235° in the calorimeter. If we take the case which shows 0.10 moisture, by the application of the regular formula with $K = 0.48$, and substitute the value 0.42, the calculated result becomes 0.57 per cent., a difference of 0.47, or nearly half of one per cent. of moisture. From this result the correction for radiation should be subtracted. The use of 0.42 intead of 0.48 for the specific heat of steam therefore tends to increase the calculated result, or apparent percentage of moisture and the use of a correction for radiation to diminish it. Since they act in different directions, and since there are serious doubts both as to the correct method of obtaining the correction for radiation and as to the correct value for the specific heat of steam, it would appear that, until our knowledge of these points becomes more definite, it is better to take the old value 0.48 for the specific heat, and to leave out the correction for radiation, and then take the results as being subject to a possible error equal to about 0.25 per cent. moisture, rather than to use corrections and coefficients that have no scientific basis. In regard to the tests described above, giving an apparent average value of 0.2 per cent. moisture, the error in one direction due to neglect of correction for radiation cannot be greater than 0.1, since if a greater correction be applied to the minimum tests averaging 0.1 moisture it would make them show superheating, which did not, in fact, occur. The error in the other direction due to possible error in the valve 0.48 taken for the specific heat may be as much as 0.47, making the average moisture 0.67 per cent. if we accept the figure given by Mr. Barrus for specific heat, viz., 0.42.

These errors, however, are far less than those to which the old barrel calorimeter was liable, an error of one-tenth of a pound in weighing a barrel containing 200 pounds of water making an error equal to 1¼ per cent. of moisture. Steam engineers therefore may congratulate themselves on having such an excellent and convenient instrument as the throttling calorimeter. With thermometers and steam gauges properly corrected, and the calorimeter and short pipe leading to it from the main steam pipe thoroughly felted, and with the use of the formula above given, I think it safe to consider that the results given by the instrument are correct within 0.25 per cent. of moisture *for the steam which flows to and through the calorimeter.* The writer is, however, by no means satisfied that this steam is always a correct sample of that which flows through the main steam pipe. There is a difference of opinion between Mr. Barrus and Prof. Carpenter as to whether the holes in the perforated pipe should be ⅛ or ¼ inch diameter, and it is uncertain whether or not the perforated pipe does not act to some extent as a steam separator. It is to be hoped that some of the mechanical laboratories of some one of our colleges will soon determine these disputed questions, by condensing all the steam made by a boiler, in order to obtain its actual content of moisture, and by the use of different forms of sampling pipe. The formula $w = 100 \times \frac{H - h - K(T - t)}{L}$ is not a difficult one to use, but it requires the use of a steam table to obtain the values of H and L for the different pressures. Prof. Carpenter, in Trans. A. S. M. E., Vol. XII, page 843, gives a plate of calculation curves which show the percentage of moisture for different degrees of superheating in the calorimeter and different steam pressures. The writer has calculated by means of the above formula the figures in the following table (*for table see page* 6), which give the same result as Prof. Carpenter's curves. The figures showing differences per degree and per pound enable interpolations to be made for degrees and pounds other than those given in the table. The table does not show any minus quantities, representing superheating of the steam in the main steam pipe, as such superheating, expressed in degrees, as it should be, can be more conveniently and accurately determined without the use of the calorimeter, simply by comparing the reading of the thermometer in the steam pipe with the temperature due to the steam pressure.


Section of Tongue
H. P. 32"
Follower in 3 Parts A-A.A
Each Ring in 6 Sections.
a-a. Position of joints in Upper Ring
b.b. " " " " Lower "
20 4½ in.. Springs.
Section at Follower Joint
Follower in 3 Parts A-A.A
Each Ring in 8 Sections.
a-a. Position of joints in Upper Ring
b.b. " " " " Lower "
32—4⅝ in.. Springs.
M. P. 52"
Brass Tongue
Brass Tongue
American Machinist



ENGINES FOR THE STEAMSHIP EL NORTE.

Engines for the Steamship El Norte.

With this we give an illustration of the engines for the iron steamship El Norte recently built and launched by the Newport News Shipbuilding and Dry Dock Co., at Newport News, Va. She was built for the Southern Pacific Co. (the Morgan Line), and will run between New York and New Orleans. The vessel and machinery have been built under the Superintendence of Horace See.

The engine is of the triple expansion type, cylinders 32, 52, and 84 inches diameter, 54 inches stroke. The distribution of steam in the high-pressure cylinder is controlled by one piston valve, another valve of the same type performs a similar duty for the intermediate cylinder, and two piston valves are used for the low-pressure cylinder. The steam is introduced in the middle of each valve, which prevents the high-pressure steam from coming in contact with the valve stem stuffing boxes. All are worked by the See-Marshall valve gear, and each valve receives its motion from a separate eccentric; the valves are placed as close as possible to their respective cylinders. In the high-pressure and intermediate valve gear, levers are introduced and connected to the valve stem and valve gear in such a manner as to cause the weight of the valve to counterbalance the

weight of the connections below the lever, thereby dispensing with counterbalancing cylinders. The engines are reversed by steam.

The main pistons are provided with Mr. See's patent adjustable followers, of which we give separate illustrations. Each follower, as will be seen, is cut in three parts, so as to permit of adjustment to compensate for wear and of centering without the employment of tail rods, and will at the same time insure a steam-tight piston without undue friction. These followers are applicable to horizontal, vertical or inclined engines.

The general construction is so plainly shown that a further description is unnecessary. Pistons with these adjustable followers are now in use on the steamers "Connecticut," "El Sol," "El Toro," "Dorothy," "Morgan City" and "El Sud," and we are informed that they give excellent satisfaction. The piston rods for the El Norte are 7½ inches diameter; these and the valve stems are fitted with metallic packing. The crank-shaft is 16½ inches diameter; crank-pins, 16½ inches diameter by 16½ inches long; cross-head pins, 8 inches diameter, 9½ inches long. The shaft is fitted with Smith's adjustable thrust bearing, consisting of go-ahead and backing bearings. The air-pump, single-acting, is 32 inches diameter; stroke, 25 inches. Total cooling surface in condenser is 6,400 square feet. An independent centrifugal circulating pump is connected to the condenser, sea bilge and ballast tank.

Steam will be furnished by three double-ended boilers 13 feet 10 inches diameter and 20½ feet long; each contains six corrugated furnaces 43 inches inside diameter. Total grate surface, 400 square feet; total heating surface, 10,650 square feet; working steam pressure, 165 pounds. The propeller is a built-up one with four blades; it is 18 feet diameter, pitch 22 feet, true screw.

At a very recent trial the "El Sud," which is a sister ship of the "El Norte," also built at Newport News for the Southern Pacific Co., and whose engine is an exact duplicate of the one here shown, it developed 3,362 indicated horse-power with a steam pressure of 165 pounds, and running at a speed of 73 revolutions per minute.

The "El Norte" is an iron freight vessel of 4,500 tons register and of the following general dimensions: Length of hull between stem and after-side of propeller post is 380 feet; breadth of beam molded, 48 feet; depth from top of keel to top of upper deck beams of lowest part of sheer, 33 9 feet; length over all, 406 feet. She has three decks and a partial orlop deck at fore-end and fore-hold. She will be rigged with four iron pole masts, and the necessary booms for handling cargo, together with steam hoisting engines located at different hatches to work in connection with them. She is to have a Williamson steam steerer, to be handled from the forward pilot house or by screw hand-gear from after house.

The Ingersoll Milling Machine and Cutters.

We illustrate on this page a new milling machine which is now being made by the Ingersoll Milling Machine Co., of Rockford, Ill., illustrations showing the system of cutters which they manufacture and use being also given.

The machine, as will be noticed, has a solid box bed extending to the floor, the table, which in this case is 20″ wide, resting upon broad surfaces at the top of this bed, to which it is gibbed and driven by a rack of 3 diametral pitch, 4″ face; the gear which drives this being 24″ diameter. The table has a traverse of 5 feet, and work 22 'x22″ will pass between the standards, which, as will be seen, are of very substantial proportions. Work 18″ high will pass under a cutter 4½″ diameter.

The method of obtaining the feed motion for the table will be readily understood from an inspection of the view showing the front or working side of the machine. Two worm-wheels with worms are provided, giving a ratio of speeds between the table and the feed belt that gives a powerful feed, and one that is very steady. There are four changes of feed for each speed of the cutter arbor, ranging from 3¾″ per minute when the cutter arbor speed is 32 revolutions to $\frac{5}{16}$″ per minute when the cutter arbor is speeded at 19 revolutions.

The system of gearing for driving the cutter arbor will be understood from an inspection of the rear view of the machine, where will also be seen the means by which a lateral adjustment of the cutter arbor is secured, which permits the work to be placed in any convenient position on the bed, and the cutters afterwards adjusted to suit it.

On the elevating screw nearest the operator is a dial which indicates vertical movements of the arbor in .001 of an inch. This machine has been proven to be very efficient for various classes of work, including cross-heads, key-seating and splining, or milling plane surfaces, its capacity in the last-named class of work being to mill a surface 20″ wide at the rate of 2″ per minute.

The cutters shown are only to indicate the forms made, as, of course, they can be of any desired form or proportions, from a plain slabbing cutter to those suitable for milling intricate forms.

It will be noted that the cutter is composed of a body which may be in one or more pieces into which teeth made of round steel rods, or those of rectangular section are inserted in such positions that but few of them strike the cut at precisely the same time, and yet their paths overlap, so that the result is a very smooth surface, while the cutters are very free cutting.

Fig. 3 shows the form suitable for milling crossheads of the four-bar type, and, of course, can be made of any needed proportions. Crossheads of this class 12¾″ wide over all and 11″ long have been milled with

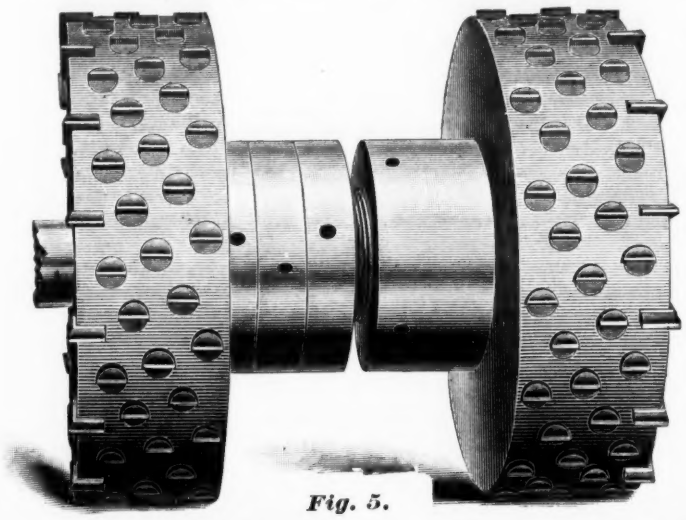


Fig. 5.

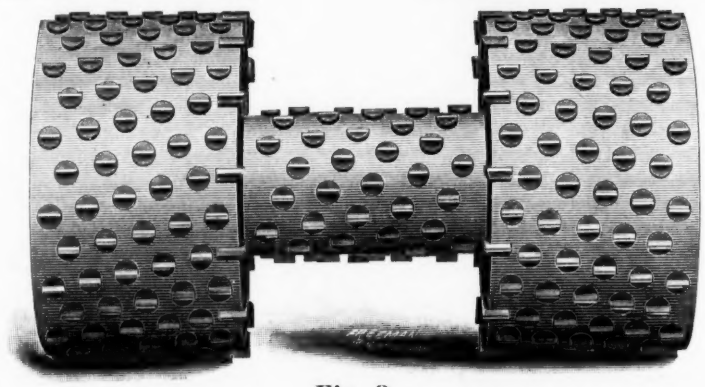


Fig. 3.

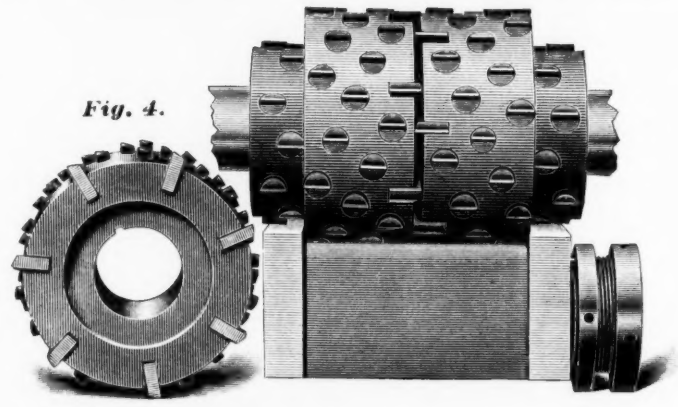


Fig. 4.

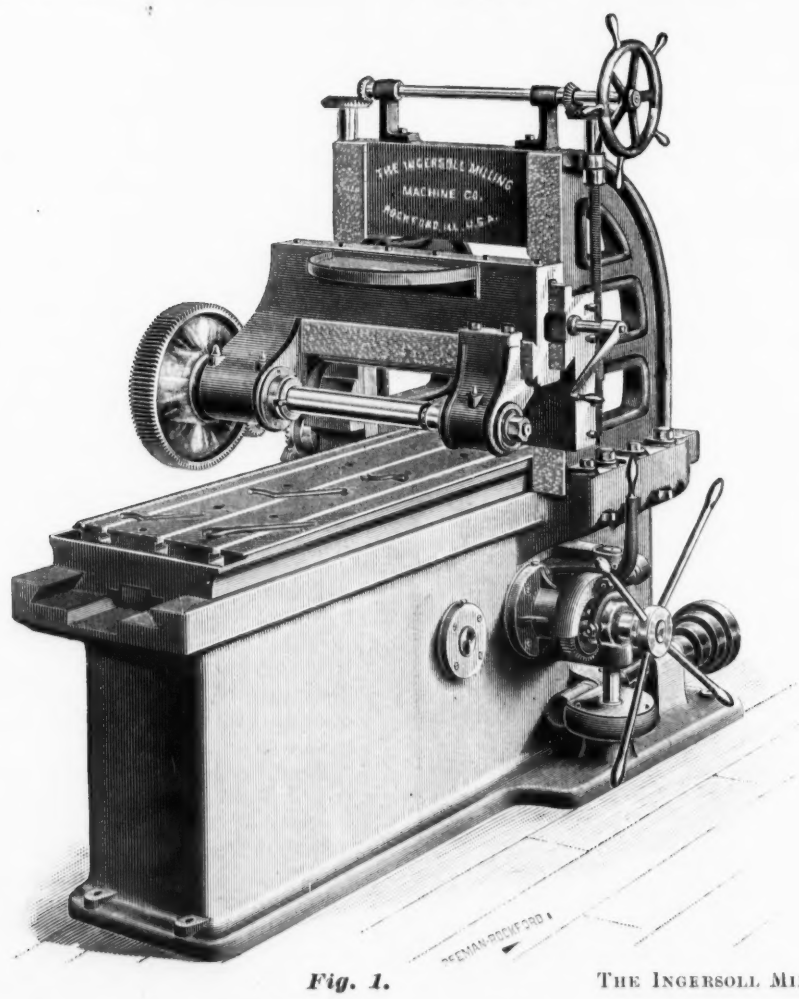


Fig. 1.

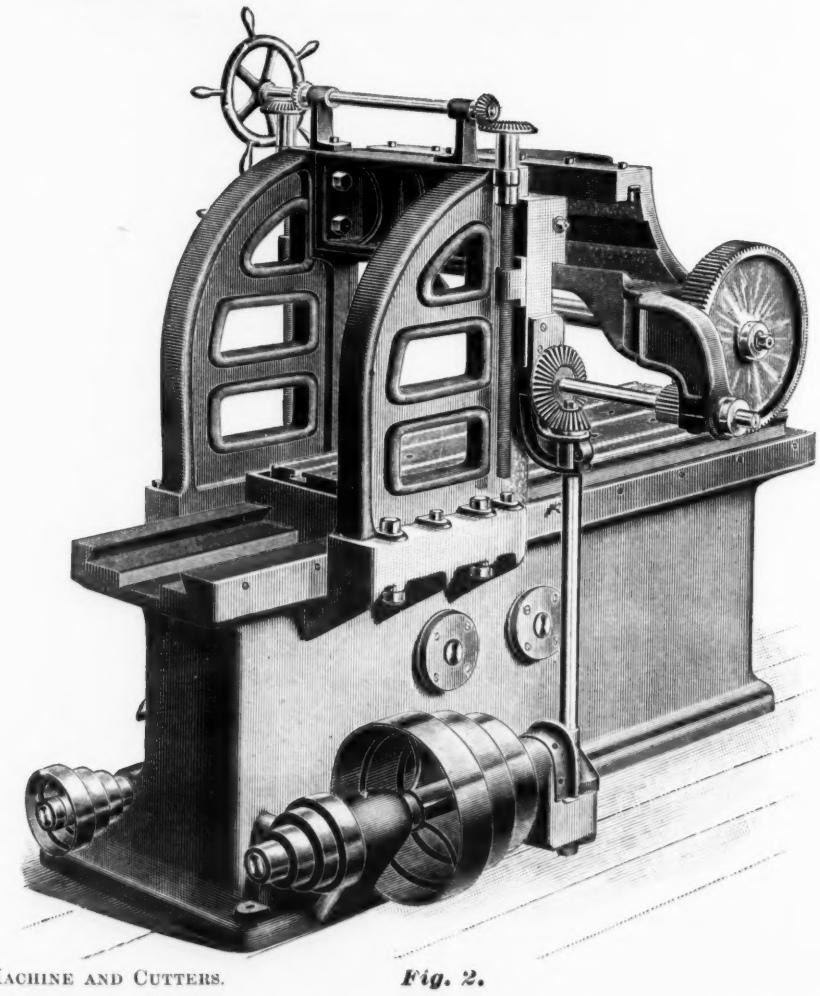


Fig. 2.

THE INGERSOLL MILLING MACHINE AND CUTTERS.

this machine and cutters, the rate being 150 crossheads in 130 hours.

At Fig. 4 is shown the form of cutter employed for milling rod and other boxes of the form shown, a screw washer of the form shown at the right of the engraving being used between the two parts of the cutter to maintain the proper distance between the flanges, and the inside teeth of the two principal parts being made to overlap as shown, so as to allow for an adjustment of $\frac{3}{16}''$. There have been milled in 50 hours 60 complete boxes for the crank end of a connecting rod, the brasses measuring over all $9\frac{5}{8}''$x $6\frac{3}{4}''$x4″, and the same number of brasses for the crosshead end of the rod measuring over all 7″x$3\frac{3}{4}''$x$4\frac{1}{2}''$, all the work being exact to size, ready for fitting up and finishing.

Fig. 5 shows a form of cutter made for milling large cast-steel boxes. The cutters are in this case 3″ wide, 10″ diameter, and can be adjusted to take up wear, and for grinding the side teeth by the screw collar shown. The company make also a cutter grinder adapted for grinding these cutters, though they can be ground on any good cutter grinder. A milling machine is also made which will take work 36″ wide and mill 9 feet long. The machine illustrated weighs 10,000 pounds.

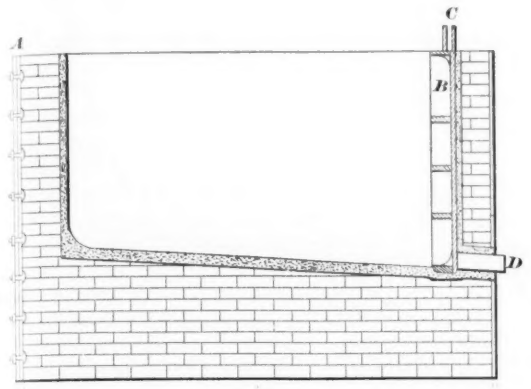


Fig. 2.

Fig. 5.

Fig. 3.

Fig. 4.

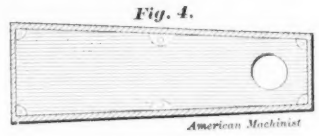


Fig. 6.

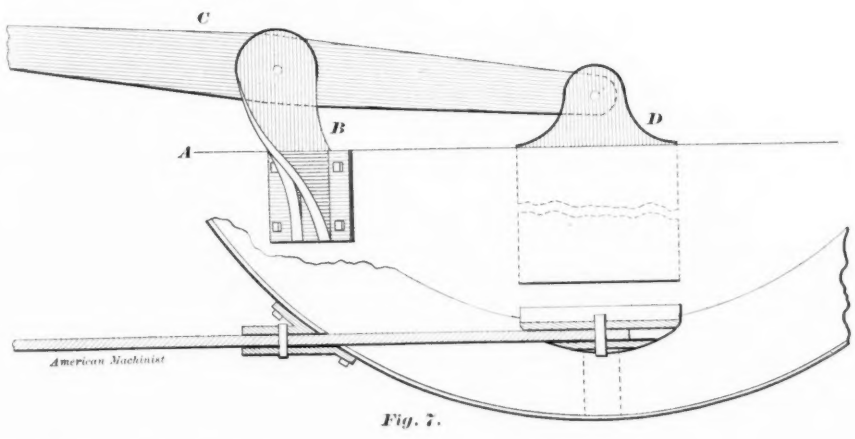


Fig. 7.

It is estimated by a New Hampshire granite manufacturer that it will take ten years to bring the business back to where it was before the strike.

Casting One Hundred Tons of Iron.

SHOWING THE CONSTRUCTION AND USE OF THE NECESSARY EQUIPMENT FOR POURING HEAVY CASTINGS.

BY S. BOLLAND.

Castings weighing 100 tons, and over, are not made every day, consequently there are very few foundries that may be considered as permanently equipped for such a task.

Strange as it may appear, whenever a casting of such magnitude is needed it is almost invariably made where the facilities for producing work of that description are far below the average.

One reason for this is that, on account of their extraordinary bulk, such pieces are difficult to handle and ship; it becomes, therefore very prudent to cast them as near as possible to the place for which they are intended.

I have in my mind a casting that weighed 185 tons; it was required for a steel works, and was made in a foundry close by, with no facilities whatever for casting a piece of such massive proportions. Special cupolas of large capacity were erected for the production of the molten iron, and taken down again when the casting was completed.

But there are other difficulties in the way of the founder who may have been requested to produce this class of work, foremost of which is the fact that the ability of his workmen is not up to the standard of excellence that will warrant him in undertaking such jobs indiscriminately. He knows that, to successfully melt and care for so large a quantity of molten iron, something more than theoretic knowledge is required; there must be judgment, founded upon a wide experience in such matters, to insure success in all the various details connected with the process, and he well knows that failure in any one of these details involves the loss of all.

If a casting requiring 100 tons of iron was ordered at a foundry where the facilities for melting were adequate to the task, and where they were provided with cranes, suitably located and of the requisite power for handling the whole amount in four ladles holding 25 tons each, the matter is then simple enough; but foundries with such ample facilities are few in number, and we must therefore continue to devise schemes that will accomplish the desired end without the aid of such extraordinary helps.

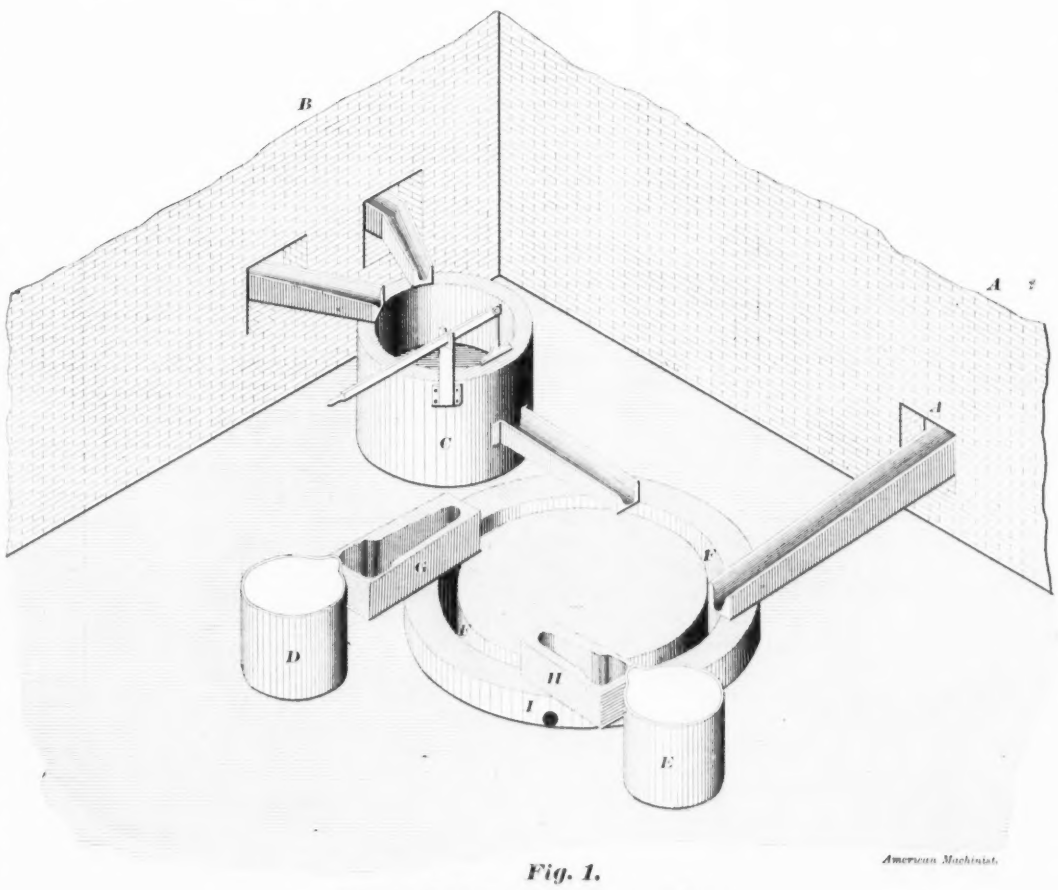


Fig. 1.

CASTING ONE HUNDRED TONS OF IRON.

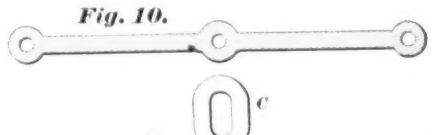
One chief help in accomplishing such a job in an ordinary foundry, and which might with profit be more generally adopted, is the dam, temporarily or permanently constructed, for the purpose of collecting therein a larger quantity of molten iron than could possibly be handled in ladles.

The reservoir of the reverberatory furnace can be utilized as a dam also, by enlarging its dimensions for special occasions, and always insures a supply of good hot iron proportionate to its capacity; this cannot be as confidently said of the dam erected on the foundry floor, because the condition of the iron in the latter will depend upon the length of time taken to melt the whole quantity, as well as its temperature when tapped or poured therein.

A thorough knowledge of the use of the dam will enable a very small foundry, with limited crane accommodations, to turn out some comparatively heavy work in a manner truly astonishing to those unaccustomed to their use.

In order to show the entire details connected with a cast of 100 tons, and to make plain the method by which this may, with safety, be accomplished in an ordinary heavy-work shop, I have made, at Fig. 1, a rude

Fig. 10.



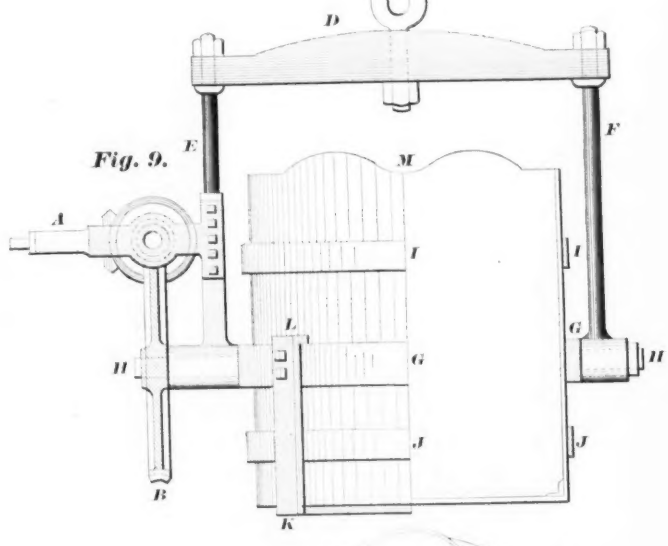


Fig. 9.

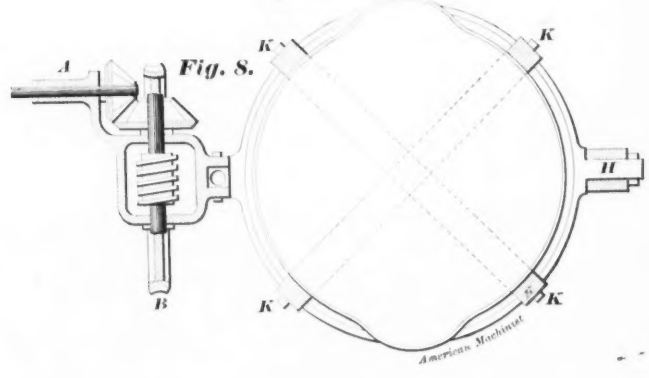


Fig. 8.

sketch of that portion of the foundry which is occupied by the mold to be poured, as well as the arrangement of the means for pouring.

The mold, as will be seen, is round, and as the object of this writing is to explain the method of pouring only, none of the necessary appendages for building such a mold are shown, as they would have interfered too much with the direct view of the whole system to be explained.

Behind the wall, at *A*, is supposed to be a reverberatory furnace capable of holding 20 tons; and again behind the side wall, at *B*, are two cupolas, each of which melts 8 tons per hour; this would yield 48 tons in three hours, and is the amount required to fill the dam shown at *C*. It is unnecessary to say that the iron must be allowed to collect in the cupolas before they are tapped into the dam, and that the greatest effort be made to melt the hottest iron possible; the above is supplemented by the two crane ladles *D* and *E*, each holding 16 tons. For the reasons previously explained, the bare shells only are shown.

This brings the total up to 100 tons of molten iron, which, if rightly managed, may be run into the mold with a dispatch that, to the uninitiated, appears marvelous.

The ladle *E*, as well as furnace and dam, connect directly with the main runner *F*, but the ladle *D* is supposed to supply a supplementary gate, which leads to the lowest portions of the mold, with the view of well covering such parts before the iron begins to drop down from the upper gates.

Very much of the trouble attending this method of pouring arises from the inadequate runner space provided; it is very important that all runners for this purpose should be capacious, and no effort should be spared to effect that object; the fewer the points which must be watched during the operation of pouring, the easier and safer will it be to conduct such operations.

The main runner, shown at *F*, Fig. 1, is supposed to be about 14 feet inside diameter, and if made 18 inches wide by 2 feet deep would hold about 20 tons; the margin of safety in such a runner as this is very large, and that is what it should be for a casting of such magnitude.

I have shown at Fig. 2 the correct form of runner best suited for work that is to be bored, and which must, for obvious reasons, be dropped from the top. It will be seen that a steep grade towards the inside is given at the bottom; this gives instant motion to the molten iron towards the runners, covering them at once, and thus preventing any possibility of their "drawing air."

Runners, spouts, and pouring basins, for these occasions, should be prepared in dry sand or loam, if absolute safety and clean work is aimed for. Figs. 3, 4 and 5 are plan and elevations of the requisite parts for constructing a box in which to form the basins, as seen at *G* and *H*, Fig. 1. The end furthest from the ladle can be made open, as shown at Fig. 5; by so doing it becomes easy to make a connection with any other system of running, which circumstances may necessitate.

The dam seen at *C*, Fig. 1, is supposed to be 8 feet 3 inches diameter and 4 feet deep, inside measurement, and will hold 48 tons, as before stated. It is provided with a shutter and lever for controlling the flow of iron, as seen, but in order that a better understanding of how to construct such a dam may be arrived at, I have shown the same in plan and sectional elevation at Fig. 6.

For ordinary occasions, smaller dams can be more temporarily constructed and made up with old sand, if extra care be taken to prevent the bottom from being cut with the first iron, but for larger jobs, and especially for such a one as we now have under consideration, a strong casing of boiler plates bolted together, as seen at *A*, must be provided, inside of which the dam must be formed by building loose bricks below until the course which forms the bottom is reached, when it is advisable to set these closer together on a bed of loam; this will prevent any tendency to leakage.

The shutter shown at *B*, Fig. 6, may, by some, be thought too elaborate for such a purpose, but if they will call to mind the numerous errors which have been made for want of a reliable shutter, they will hesitate before venturing an adverse criticism.

As seen, the shutter is a circular cast-plate with strengthening ribs across; these ribs also serve to hold the fire-bricks which must be built between them. The lugs shown at *C* connect with the lever used for raising and lowering the shutter. The details of this arrangement are shown in plan and elevation at Fig. 7; the line at *A* representing the top of the dam, *B* the fixing (secured to the tank) which supports the lever *C*, and *D* the lugs which correspond to those seen at *C*, Fig. 6.

It is intended that the shutter shall be set in position with the 6-inch plug *D*, set behind when the wall is built, and if proper provision is made it can be taken out (to facilitate drying) after the wall has been loamed over. When the shutter has been built around in the manner described, there remains little to be done in the way of fitting; after it has been bricked and loamed on the inside, let it be thoroughly dried and set back in its original position.

The round side being clean, there is very little friction, consequently it answers readily to the pressure of the lever, and enables the assistant to regulate the stream at will.

By an arrangement, such as described above, the hole may be made very large with safety; this, of course, leaves nothing to chance, as any degree of speed, in pouring, may be obtained by simply raising or lowering the shutter.

It is needless to say that all such dams as these must be thoroughly dried, and as near red-hot as possible when the first tap is made into them. As soon as the tap has been made, it is well to cover the surface of the iron with charcoal, the pieces of which are from 2 to 3 inches diameter, then fill the interstices with a finer sort, taking care that no open spots are left. As an extra precaution, cover the whole dam over the top with sheet-iron plates; by this means the iron can be kept in a good fluid condition for a very long time, providing it was hot from the start.

It will be noticed that the top of the runner is 2 feet above the floor; this, of course, means that the bottom of the dam must be as much above that level as will allow a gradual and easy descent in the direction of the runner; also, if the great advantage of having the cupolas tapped directly into the dam be desired, their bottoms must be slightly higher than the top of the dam, as seen at Fig. 1.

The crane ladles which would be required for this occasion are somewhat larger than those commonly used, and for this reason it is well to notice some of the chief points which go towards making a good ladle.

Figs. 8 and 9 are plan and elevation of a 16-ton ladle, which, when lined with brick and covered with a thin daubing of loam, must measure 54 inches diameter and 56 inches deep.

The gearing is preferably arranged so that the operator may stand on the side whilst he turns the ladle. Two very bad features in many geared ladles are corrected in the one shown; usually the bearing at *A*, Fig. 8, is too short, in consequence of which, both bearing and shaft are destroyed in quick time; this one is 12 inches long.

The other common error is to make the worm-wheel *B* too small in diameter; this makes it very hard to work, besides causing greater wear and tear on the rest of the machine; the worm wheel for this ladle is 3 feet 6 inches diameter. By all means let all the parts of a geared ladle be machined in the best way; it is a mistake to think that anything else will do.

The shell is made of $\frac{5}{8}$ inch boiler plate, with a bottom $\frac{1}{2}$ inch thick, and the dimensions of the principal parts are as follows: Lifting eye (*C*) 9 inches by 4 inches, made from 3 inch round steel; beam (*D*) 10 inches deep in the middle, $2\frac{1}{2}$ inches thick; slings (*E F*) $2\frac{1}{2}$ inches diameter; middle band (*G*) 8 inches by 3 inches; shafts on band (*H*) 4 inches diameter; upper and lower bands (*I J*) 6 inches by $1\frac{1}{2}$ inches; bottom bands (*K*) 6 inches by $1\frac{1}{2}$ inches; these latter cross each other underneath, as shown by broken lines in Fig. 8, and extend upwards to the middle band, resting thereon by a toe provided for the purpose, being further secured thereto by bolts, as seen at *L*, Fig. 9.

This form of lifting eye works more advantageously than any other: it is always in position for use, and the oval shape favors rapid handling, and is not as liable to fracture as round eyes are. Be sure that $\frac{1}{4}$-inch holes are drilled on the bottom for the escape of steam; this saves the bottom from raising when there is moisture lurking there.

The style of lip shown at *M* is to be recommended, on account of the favorable stream which is formed by it when pouring. It is well known that if the pouring is to be rapid from the start, most ladles at the beginning deliver the iron in a wide sheet, making it necessary to construct very wide basins; this form of lip controls the stream by preventing the spreading spoken of, and makes the operation of pouring much more pleasant.

It may be well to state just here that this style of ladle is the best for all sizes of crane ladles; all the difference to be made is to suit the strength to the capacity. I have a decided objection to all crane ladles that are not geared, for they are not only dangerous tools to work with, but they invariably require about 100 per cent. more help to manage them.

It is wise to put a brick lining into all ladles down to 8 tons, below which capacity the bottom can be safely made by laying first, about one inch of fine cinders, over which let two inches of soft silica sand be spread very evenly, and then rammed down hard; such a bottom as this will never fail if the holes are kept open and the sand be thoroughly dried before using; an even daubing of one inch will suffice on the sides.

The following table gives the dimensions, *inside the lining*, of ladles from 25 pounds to 16 tons capacity, and will be found useful to all who do not care to make the necessary calculations. It will be well to notice that all the ladles are supposed to be straight ones, after the manner shown in the engravings.

Capacity.	Diameter.	Depth.
16 Tons	54 Inches.	56 Inches.
14 "	52 "	53 "
12 "	49 "	50 "
10 "	46 "	48 "
8 "	43 "	44 "
6 "	39 "	40 "
4 "	34 "	35 "
3 "	31 "	32 "
2 "	27 "	28 "
1½ "	24½ "	25 "
1 "	22 "	22 "
¾ "	20 "	20 "
½ "	17 "	17 "
¼ "	13½ "	13½ "
300 Pounds	11½ "	11½ "
250 "	10¾ "	11 "
200 "	10 "	10½ "
150 "	9 "	9½ "
100 "	8 "	8½ "
75 "	7 "	7½ "
50 "	6½ "	6¾ "
35 "	5½ "	6 "
25 "	5 "	5½ "

It will be natural to suppose that the ladles *D* and *E*, Fig. 1, have to be filled by means other than those we have spoken of; such means may be one, or perhaps two cupolas, in addition to the ones mentioned.

The correct time to start the several furnaces is an important matter, and should be figured out as closely as possible; this can always be done with a measurable degree of certainty if the reverberatory furnace has been used previously, but should the latter be a new furnace, great care and judgment must be exercised to ascertain about how long it will take the 20 tons to melt; this done, the cupolas must be started at just such times as will bring about as even a finish as possible.

And now supposing that the dam is full, the two ladles filled and in position, and all the iron melted in the reverberatory furnace, place a reliable man at the lever who will be ready to obey orders, and have all the tools ready for opening the tap hole at the reverberatory, should it prove refractory, which will certainly not be the case if the instructions previously given for making up the tap hole have been strictly followed out.

Let ladle *D* commence first to fill the bottom, and continue to pour until all is out; immediately after the first ladle is started, open dam and furnace simultaneously, until the runner is about half full, when the dam may be checked, and allow the reverberatory to run clean out; but should it be found that the stream from the furnace is insufficient to keep up the requisite amount of head pressure, the dam can be kept open sufficient to effect this object, gradually increasing the speed at the dam as the stream slackens at the furnace, until when all the iron is out of the latter the dam may be emptied, and ladle *D* allowed to finish the cast.

The important object gained by distributing the iron as above described is, that the furnace, dam, and one of the ladles are sure of being cleaned out, thus leaving but one stream to attend to; the mold can then be filled to a nicety, without leaving too much iron in the runner.

Any surplus in the ladle can be used for other molds which may have been purposely made for the occasion.

As it is barely possible to maintain the legitimate head pressure up to the last with-

MOISTURE IN STEAM—DETERMINATIONS BY THROTTLING CALORIMETER.

Discharging at atmospheric pressure. Formula: Per cent. of moisture = $\frac{H - 1146.6 - 48\,(T.\ 212°)}{L}$.

Gauge Pressures.													
Degrees of Superheating *T.* 212°.	5	10	20	30	40	50	60	70	75	80	85	90	95
Per Cent. of Moisture in Steam.													
0°	0.51	0.90	1.54	2.06	2.50	2 90	3.24	3 56	3.71	3.86	3 99	4.13	4 26
10°	0 01	0 39	1.02	1 54	1 97	2.36	2 71	3.02	3 17	3 32	3 45	3.58	3.71
20°	....	. .	.51	1 02	1.45	1.83	2.17	2 48	2.63	2 77	2.90	3 03	3.16
30°	....	...	.0	.50	92	1.30	1 64	1 94	2.09	2 23	2 35	2 49	2 61
40°	....	....	....	..	.39	.77	1 10	1.40	1 55	1.69	1 80	1.94	2 07
50°	....	....	....	....	....	.24	57	87	1.01	1.15	1.26	1.40	1.52
60°	....	....	....	....	....	....	.03	.33	.47	.60	.72	.85	.97
70°	....	....	....	....	....	....	....	....	....	.06	.17	.31	.43
Difference per degree.	.0503	.0507	.0515	0521	.0526	.0531	0535	.0539	.0541	.0542	0544	.0546	.0547

Gauge Pressures													
Degrees of Superheating *T.* 212°.	100	105	110	120	130	140	150	160	170	180	190	200	250
Per Cent. of Moisture in Steam.													
0°	4 39	4.51	4.63	4 85	5 08	5 29	5 49	5.68	5.87	6 05	6.22	6 39	7.16
10°	3.84	3 96	4.08	4 29	4.52	4 73	4.93	5.12	5.30	5 48	5.65	5.82	6 58
20°	3.29	3.40	3 52	3 74	3 96	4.17	4 37	4 56	4 74	4.91	5.08	5.25	6 00
30°	2 74	2 85	2.97	3.18	3 41	3 61	3.80	3 99	4.17	4 34	4 51	4 67	5.41
40°	2.19	2.30	2.42	2.63	2 85	3.05	3 24	3.43	3.61	3.78	3 94	4.10	4.83
50°	1 64	1.76	1.87	2 08	2 29	2.49	2.68	2 87	3 04	3 21	3.37	3.53	4 25
60°	1.09	1.21	1.32	1.52	1.74	1.93	2 12	2 30	2 48	2 64	2.80	2.96	3 67
70°	.55	.66	.77	.97	1.18	1.38	1 56	1.74	1 91	2.07	2 24	2.38	3 09
80°	.00	.11	.22	.42	63	.82	1 00	1.18	1.34	1.50	1.66	1 81	2 51
90°	....	....	....	....	.07	.26	.44	.61	78	.94	1.09	1.24	1.93
100°	....	....	....	....	...	...	...	.05	.21	.37	.52	.67	1 34
110°		....	....	....	....	....	....	....	....	....	....	.10	.76
Difference per degree.	.0549	.0550	0551	.0554	.0556	.0559	.0561	.0564	0566	.0568	0570	.0572	.0581

(*For Explanation of Table see page 3.*)

out leaving considerable iron in the runner, and as the runner in this case is unavoidably bulky, provision must be made for letting off the same into pig beds, formed in the immediate vicinity of the mold, as seen at *I*, Fig. 1. This at once converts what would otherwise have been an ugly piece of scrap to deal with, into very desirable pig-iron, which may be broken into smaller pieces whilst hot.

LETTERS FROM PRACTICAL MEN.

Truing Emery Wheels—Friction Cones—Boring Bar Cutters.

Editor American Machinist:

In your issue of April 21st, "Repairs" speaks of using a "stub end" of an old coarse emery wheel for truing up another finer wheel. I have seen it done quite frequently with fair success in some cases, the most successful being on the edging wheel in a brass foundry, but on the wheel in the tool grinder it was not a howling success, the main difficulty being that it glazed the wheel badly, much worse than the pipe did. Now the pipe method is not my favorite; these spur wheel arrangements give much better satisfaction, and I know of one emery wheel factory where they are used in preference to the diamond. This factory (and they make some fine wheels, too,) also uses the screw truing device, such as we often see used on grindstones, and they seem to do good work, and last a good while, too.

I should like to ask those who have had considerable experience with the diamond, whether they find it advantageous to run the wheels at a much slower speed than is used for grinding, or whether they true the wheels at the ordinary high speed.

"Steam Feed" speaks of friction cones, both straight and taper, and I think he is the man I have been looking for. Have made several inquiries about a friction device for transmitting a small power at a right angle (or other angle), but none of the shafting men with whom I have spoken seemed to know much about it. I should like to have "Steam Feed" or any one else give me some information concerning these paper friction cones.

We had a tenant in the next building who wanted about three horse-power, and neither of us wanted a hole in the wall large enough for the belt to run through. So we made inquiries as to frictions, etc., for transmitting it direct from the main line shaft to a shaft running through the wall, but could find nothing of the kind around.

Time was an object, and so we had to resort to a quarter-twist belt device, and run a shaft through the wall at some distance from the main shaft (an upright) and then belt back on the other side of the wall. Personally, I should have preferred bevel gears for the small amount of power, for it is a positive drive, and the noise need not be an objection if they are put up in good shape, but the belt won the day. What powers are these friction cones (of paper or other material) transmitting, and are they giving good satisfaction?

The idea seems to prevail in all, or nearly all the boring bars that we see illustrated, that there must be some fine centering device in order to have the cutters go in place correctly. Now, of course, it is necessary to have the cutters go in place alike every time, but is there any need of the guiding pin or center being in the center of the bar, or being made so costly as we usually see it? I think not.

In the issue of April 7th, "J. R." gives a sample of what may be termed a regulation style of fastening the cutter. There have been several similar styles shown in mechanical journals lately, and to me they bear the imprint of a too expensive construction. Why is it necessary to have the centering device in the center of the cutter? The only need of exactness in this respect is where it is necessary to have the cutter reversible in the bar, capable of being put in and used either side up. But what is the use of this?

By just marking the cutter in some way, simply pricking with a center punch, or using letters or numbers, or grinding a "spot" after hardening and tempering it, will always show the right side of the cutter, and a corresponding mark on the bar makes putting the cutter in wrong, a matter of pure, unadulterated carelessness.

I have made and used boring bars in which this mode of fastening (fastening the cutter in place after putting the bar through the work) was necessary, for a number of years—nine, I think—and have never made one of the precise kind as yet, nor see any necessity for so doing, at least on our kind of work. If there is a place where the work demands it, I should like very much to see the work.

We have had no trouble whatever with the cutters being put in wrong, and spoiling work as a consequence; it simply requires the operator to look at the cutter before putting it in place, and the time that this occupies does not count very much in a day's work. In Fig. 1 is a style of bar we use quite frequently, and one which has given entire satisfaction on the larger sizes of work; on the small work it does not pay, nor is there room for the nut, as shown.

This is very similar to the bar shown by "J. R.," excepting the centering device.

This, as will be very readily seen, is merely a pin driven through the bar at the end of the slot, so that half of the pin will project from the bar into the slot, and thus form a center for the corresponding notch shown in the

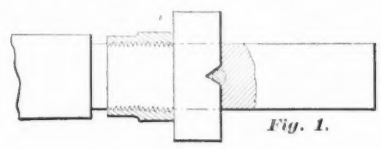


Fig. 1.

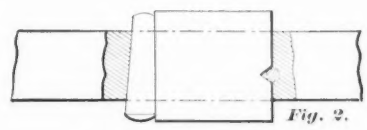


Fig. 2.

Fig. 3.

BORING BAR CUTTERS.

cutter. These notches are usually filed into the cutters with a square file, care being taken to round the bottoms of the notch to avoid a sharp corner for a crack to start from in hardening.

A round file can also be used to advantage, care being taken that the notch is not deep enough to throw the cutter against the flat face of the slot before striking the pin, as this would allow a side motion depending upon the depth of the notch.

The nut screws up (by a hex.) from behind, and holds the cutter in the same manner as the bar shown by "J. R." In Fig. 2 another style of bar is shown, which also gives good satisfaction, and is used more for bars in which the cutters are not often removed, as the jar of the turret lathe on heavy work might loosen the key; this could, of course, be obviated in several ways; for instance, by having a small clip for holding the key, or by the use of a spring. In this bar the centering pin in the bar is shown purposely very much to one side, merely to show that, with a good holding device behind the cutter, as a well-fitted key (the nut, as shown in Fig. 1, would hold it equally as well) the cutter will go into the same place every time.

It is possible ordinarily to drill this centering hole (for the pin to be driven into) very near the center, but exactness is not required, as this will show, in case the drill should run out as much as shown, the bar would still be available for use.

Fig. 3 shows still another form that we use to considerable extent, especially for small bars, and combinations of all three styles is also much used. For instance, we use a pin for the front centering, and also a pin to drive in behind the cutter (as shown in Fig. 3) to fasten and hold it to place, or we combine other methods, but the samples will give a good general idea of them all In the last figure (3) it will be seen that the front centering is done by a projection of the bar itself; this is left when the slot is being mortised, and, like the pin, need not be in the exact center to do its work in good shape. The taper pin for holding the cutter in place as in Fig 3, will prove a very simple device when the work is small, or when the changes are to be made in a hurry, and by arranging the bar so that the head (or larger end) of the pin is on the top, the jar will tend to work the pin "in" rather than out. Some of the readers may know what disastrous effects follow the loosening of the cutter during the operation, and know why it is so desirable to avoid it if possible. The arrows on the bars indicate the direction they are to cut, and this seems necessary many times, but, when possible, I prefer to have the key or other fastening device in "front" instead of behind the cutter.

When this can be done, the key and the work are both tending to hold the cutter on the centering device, whatever that may be, while in the manner shown, the work tends to counteract the effect of the fastening, and force the cutter away from the centering.

Cutters that have to be removed from the bars frequently are very often merely pinned in place; this, however, has some objections as well as advantages.

Where the pin draws the cutter against the back of the slot, the cutter is sometimes fractured by the pressure, especially when the cutter does not bear directly back of the pin, but at two points toward the edge of the bar. Where it does not draw the cutter as mentioned, two pins are required to hold it steadily, or else the cutter must be a snug fit in the slot to prevent a swinging motion when in a cut.

To these we must add the tendency of steel to crack in hardening, when it has a hole through it, so that it is advisable to avoid the holes where convenient.

FRED HERBERT COLVIN.

U. S. Cruiser "Columbia."

The United States cruiser "Columbia," known throughout her construction as the "Pirate," was successfully launched from the yards of Messrs. William Cramp & Sons, Philadelphia, Pa., on the 26th ult. She is the first triple-screw war ship built for the U. S. Navy, designed for a very fast speed, and in this respect she is expected to be superior to any of the ocean greyhounds; in fact, there is every reason to believe that she will be the fastest ship afloat. One propeller occupies the usual position as in ordinary single-screw vessels, the other two are placed at the sides of the vessels, about 7 feet 3 inches forward of, and their centers about 2 feet above that of the central one. Each propeller is driven by a separate engine. These are of the triple-expansion, vertical inverted cylinder type.

The cylinders are 42, 59, 92 inches diameter, and 42 inches stroke. The estimated indicated horse-power is 21,000, and the guaranteed speed of vessel is 21 knots; for each ¼ knot above this the builders are to receive a premium of $50,000. Each engine is placed in a separate water-tight compartment, and is complete in every respect, so that the vessel may be propelled at a slow speed by the center propeller alone, by the two outer ones at a medium speed, and by the three propellers when the highest rate of speed is required. This arrangement allows the machinery to be worked at its maximum and most economical number of revolutions at all rates of the vessel's speed. Each engine has a separate surface condenser with a cooling surface of 9,474 square feet. The condensers for the auxiliaries are furnished by the Wheeler Condenser and Engineering Co., of New York. The air-pumps, as well as all the pumps throughout the vessel, are furnished by the George F. Blake Manufacturing Co. of New York. The air-pumps are of the independent vertical double cylinder type, one being placed in each engine room, and each is capable of taking care of 7,000 H. P. The fire and bilge pumps and boiler-feed pumps are of the vertical duplex pattern of the latest design.

Steam is furnished by eight double-ended boilers, six of which are 15 feet 6 inches outside diameter; total length, 21 feet 3 inches. Each contains eight corrugated furnaces 3 feet 3 inches inside diameter. Grate surface in each, 175 5 square feet; heating surface, 5,932.4 square feet; ratio of heating to grate surface, 33.8. The other two boilers are 11 feet 8 inches diameter, 18 feet 8½ inches long. Each contains four corrugated furnaces 3 feet 6 inches diameter; grate surface, 84 square feet; heating surface, 2,870.2 square feet; ratio of heating to grate surface, 34.2. There are also two auxiliary single-ended boilers 10 feet mean diameter, 8 feet 6 inches long; each containing two corrugated flues 2 feet 9 inches inside diameter; heating surface, 968.66 square feet; grate surface, 32 square feet; ratio of heating to grate surface, 30.3. The length of the vessel is 412 feet; breadth, 58 feet; mean draught, 24 feet; displacement, 7,475 tons.

The main battery consists of one 8-inch breech-loading rifle, two 6-inch B. L. R., and eight 4-inch B. L. R. The secondary battery consists of two 6-pounders and four 1-pounders.

The general structural design is that of a protected cruiser, the magazines, engine rooms, boilers and steering gear being protected by an armor deck running fore and aft. It has a thickness of 4 inches on the slopes and 2½ inches elsewhere. The top of the beams of the protective deck at the ships' side is 4 feet 6 inches below the load line, and the center of the beams generally 1 foot above the load line.

The accommodations for officers and crew are excellent. Especial attention has been paid to the ventilation of the living spaces, and incandescent electric lighting will be used exclusively.

The coal capacity of the vessel is large, sufficient for an endurance of 109 days at a speed of 10 knots. In many respects the cruiser will resemble a peaceful transatlantic liner, but should there ever be a necessity to overhaul and destroy an enemy's merchantman she will undoubtedly give a good account of herself and come up fully to the expectations of her designers.

The building of this cruiser, designated No. 12, was authorized by an act of Congress, July 30, 1890. The hull was designed under the supervision of Chief Constructor of the Navy T. D. Wilson; the machinery was designed by the Bureau of Steam Engineering, under the direction of Commodore George W. Melville, Engineer-in-Chief U. S. N., Chief of Bureau. The contract was awarded to the William Cramp & Sons Ship and Engine Building Company, Philadelphia, on November 19, 1890, and according to the terms of the agreement the vessel should be handed over to the Government, completed, as far as the contractors are concerned, May 19, 1893. The contract price for hull and machinery is $2,725,000.

The dentists of New York State have, it seems, a very strong trade union, and have a law which prevents any one not a member from working at the business. A barber extracted a loose tooth for a woman a few days ago upon her request. It turned out that the woman was in the employ of the State Dental Society as a spy, and the result was that the barber was arrested and fined $50 for illegally practicing dentistry. Any mechanic who has ever sat in a dentist's chair knows that dentists are little more than good mechanics, and he also knows that it takes him several days if not a week to earn enough money to pay a dentist's bill for a few hours' work. It is in the interest of those who must employ dentists that they should be competent, but so is it with those who employ plumbers, engineers and other mechanics.

The clerks in the dry goods stores in New York object to the hours that keep them at work until nine or ten o'clock at night. They have pretty good reason to complain, but in the way business is done at present it is hard to see a way to remedy their trouble.

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

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NEW YORK, AUGUST 4, 1892.

CONTENTS.

	PAGE
A New Fourteen-inch Engine Lathe	1
Experiments with Throttling Steam Calorimeters. By William Kent, M. E.	2, 3, 6
Engines for the Steamship El Norte.	3, 4
The Ingersoll Milling Machine and Cutters	4 5
Casting One Hundred Tons of Iron. By S. Bolland.	5, 6, 7
Letters from Practical Men: Truing Emery Wheels—Friction Cones—Boring Bar Cutters. By Fred Herbert Colvin	7
U. S. Cruiser "Columbia."	7
Some New Lathes	8
The Mechanical Engineering Teachers' Association	8
Maintaining Patent Rights	8
Questions and Answers	9
Gascon Discourses Upon Some Shortcomings in Text-books—Tormenting. By Jarno	9, 10
Gage Lathe for Large Work	10
Eccentricities of Vision	10
Coal Must Go Higher	10
Manufactures	10, 11
Machinists' Supplies and Iron.	11

Some New Lathes.

We have before alluded to the fact that the recent development of our navy and coast defenses is exerting a great influence upon our machinery and tools for handling heavy work, and in nothing has this influence been more marked than in the case of lathes. An example of this is illustrated in our issue of May 26, showing several quite radical and very interesting departures from the usual practice in large lathe construction. Our illustrated description alluded to above gives all the special features of this—the most remarkable lathe in many respects ever built, but it may be worth while to call particular attention to the principal points in which this lathe departs from the usual form, especially as it seems probable that it is to exert an important influence in the future development of heavy lathes abroad as well as at home.

Commencing with the bed, it will be remembered that its main portion consists of three longitudinal members instead of two; the head-stock being wide enough to cover all of these, while the C-shaped rests in which the gun is held, together with the foot-stock, are supported upon the rear and middle members only, the bolts securing them being placed at such an angle as to draw them forward against an inclined surface, which thus insures their being always in line.

Upon the front and middle members of the bed rest the carriages, the surface of the middle member upon which they slide being in front of that to which the rests and foot stock are secured, so that the carriages may freely pass either the foot-stock or rests and be free to move to any part of the work without hindrance or interference.

Another notable departure is found in the arrangement for imparting motion to the carriages, for which purpose a fixed screw placed relatively very near the point of greatest resistance is used; motion being derived from this by means of nuts or internally threaded collars having spur gear teeth cut upon their outside surfaces, these nuts being supported upon the carriages and revolved through a system of gearing fixed to the front of each carriage and deriving its motion from a square shaft running through the bed parallel to the fixed screw. The change gears are thus placed upon the front of each carriage and it follows that the carriages may be feeding in the same or in opposite directions at the same or at entirely different speeds; or one may be turning with automatic longitudinal feed while the other is used for cutting screws, and yet they are both moved from the same screw. This construction prevents the use of an open nut, but the necessity for this is avoided by deriving a rapid traversing movement from a second square shaft, which, through suitable gearing, revolves the same nuts at a proper rate for moving the carriages rapidly.

Another very bright idea is found in the boring bench: the bar being supported in three rests besides the head by which it is rotated. The rest nearest the gun does not move during the boring, but the head which is at the rear moves forward at the same rate as the bar. The two rests between these move at different rates in such proportion that the four points of support for the bar are always equi distant from each other, this being accomplished by means of gearing of varying ratios engaging with rack teeth cut upon the bed or bench upon which these rests slide.

There are others, but these are the main features in which this lathe differs from preceding ones, and which mark it as a distinct advance in lathe construction—a fact which is recognized by machine tool men all over the world, many foreign engineers and mechanics having examined the lathe during its construction at the shops of Wm. Sellers & Co., and since it has been set up at Washington.

With some of the earlier gun lathes built here the plan followed was to obtain drawings of foreign lathes and construct mainly from them; it is very gratifying to find that, in the case of the largest and most important lathe, American designs were found to be superior to anything yet produced, and that in this lathe and some smaller ones there are features that seem likely to become standard and to be considered indispensable in any first-class gun lathe, whether in Europe or in this country.

To any one who has ever handled a lathe it is certainly a great privilege to witness the manipulation of this monster, which, not only for its immense size and weight, but for its completeness, convenience, ease of handling, power, strength and attractive appearance is remarkable, and a credit to its builders and to the country.

Some of the smaller lathes of the same design were built at the shops of Bement, Miles & Co., and the design is the result of the collaboration of the two establishments named.

In smaller lathes intended for general work some notable changes in design are also taking place; one of these, having a very novel arrangement of feed gearing, being illustrated in this issue, while we have in course of preparation illustrated articles descriptive of other lathes which depart in essential particulars from the time-honored type.

The Mechanical Engineering Teachers' Association.

We have received a copy of the Proceedings of the First Annual Meeting of the Mechanical Engineering Teachers' Association, held at Columbus, Ohio, with an announcement that the second meeting will be held at Rochester, N. Y., beginning August 18, which will make it coincide in time and place with the meeting of the American Association for the Advancement of Science. Amongst the subjects to be discussed are:

What subjects should be included in the mechanical laboratory; how much practice with the object of mechanical and manual training?

How much fine mechanical practice, such as scraping of surface plates, grinding of standards, etc.?

Should the construction of articles of manufacture be attempted at the school laboratory?

What testing should be attempted?

Should any part of the laboratory practice be classified as shop work, and so named unless articles are made for sale?

Should anything be introduced that should be called "shop work?"

Should that portion of the laboratory embracing the manual element be classified as "shop," "school shop," "work shop," etc., or elementary mechanical laboratory?

Should the more advanced portion, embracing testing of various kinds, be classified in such way as advanced mechanical laboratory, testing laboratory, etc.?

To show that there may be some difference of opinion on these points, we need only to quote from a paper read by Prof. S. W. Robinson, of Ohio, who has taken a prominent part in the organization of the new society.

"As to school shops in colleges and universities where something is to be made to sell, it is believed that no greater mistake can be made than devoting time to this that ought to be put upon the higher principles. It is an injustice to the student who seeks to prepare for the higher practice of mechanical engineering, to put his time to that which amounts to but little more than apprenticeship. This training belongs to the trade school where the student is to learn to be a workman, or at most a foreman or superintendent of a shop, who is satisfied to follow instead of leading in his practical life, instead of to a course of mechanical engineering.

"No such thing as a shop should be introduced at college to a student to be graduated as a mechanical engineer, unless he is willing to extend his time for that purpose.

"The practical part of his training should be got in a mechanical laboratory, of which, however, there may be elementary and advanced, or higher laboratory, and it is believed that the proper designation of such a place is a laboratory, and not a shop. We have no use for "shop work" in a school graduating men as mechanical engineers.

"In the elementary laboratory a certain set of pieces are to be worked out, preferably the same for all students, and on the correct educational plan of class work, and hence the place is a laboratory, and not a shop."

This will be recognized as differing radically from the opinions held by other teachers of mechanical engineering, the tendency seeming to be to get more and more of shop into the course. There will always be those who will believe that, whether the shop practice be got during the course of study or at some other time, a considerable amount of shop practice will always be one of the necessities for the highest degree of success in mechanical engineering, which any given individual is capable of attaining. This has been and is our own belief.

Maintaining Patent Rights.

The outcome of an attempt by an Ohio manufacturing company to maintain a monopoly of the manufacture of cash registering machines, may do much to clear up the question of how far a company may legally and safely go in that direction, since in this case the company referred to became so aggressive and vigorous as finally to arouse the united opposition of its competitors, who, it seems, have determined to test the matter fully.

The Ohio concern was, we believe, the first to bring these machines prominently into notice, and upon the attempt of others to make and sell machines, even though they differed radically, there was a most vigorous fight, both in the commercial field and in the courts, the claim being made that, being the first in the field, having spent thousands of dollars in advertising and educating people up to the use of such machines, they proposed to supply the demand, and that fact might as well be thoroughly understood. And they took care that it was understood, especially by those whom they thought might otherwise be induced to take an interest in any company organized to manufacture or sell a new machine, all such persons being pretty sure to see a circular or a newspaper interview in which the position of the old company on this point was candidly stated, the statement being often accompanied by some very suggestive figures as to the amount of capital available for use in "maintaining our rights." Individual purchasers of other machines or those who might be thinking of purchasing them, were given to understand that trouble was in store for them, and in one case at least a man was posted in front of the door of a competitor to note addresses of parcels going out. He was arrested, and by the court warned not to repeat the act.

The result of all this has been to bring about concerted action in the courts, and the outcome will be watched with interest.

In this connection it may be interesting to note that a bill has been introduced in Congress, which is intended to do away with the possibility of bringing any action against the innocent purchaser or user of a patented device, and confining the field of action to the manufacturer and vender. At last accounts the bill had a good prospect of passing, and we cannot see but that such a bill would be in the interest of justice, though we think that when it is shown that a manufacturer or vender has knowingly infringed he should be held responsible for all damages resulting from the infringement. At the same time there are other directions in which inventors could justly be more thoroughly protected than they are now.

A daily paper gravely announces, as though it were an important piece of news, that:

"A new combination washer and nut lock for railroad use has recently proved itself very useful. The nut can be released or tightened up with the greatest ease, and the washer can be rinsed frequently."

It is, of course, of the utmost importance that the washers used with lock nuts should

be arranged so that they can be rinsed frequently. The writer or "condenser" of that item knew, of course, that the duty of a washer was to wash things that needed washing (probably in this case Pullman towels and pillow-cases), and in order to do this work effectually it must, of course, be rinsed out occasionally to remove sediment and keep it in good working condition. Hereafter, we hope no inventor of a lock nut and washer will think of trying to impose upon the public with a washer which cannot be rinsed as often as necessary.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(323) G. G. F., Allegheny, Pa., writes: Please answer the following questions through your columns. What number of shots have been fired from a Gatling gun in one minute? When and by whom was the test made? *A.*—We have no record of any tests of this kind. It is claimed that a continuous firing can be kept up at a rate of 800 to 1,000 shots per minute.

(324) F. K., ——, Wis., writes: I wish to know where I could procure a temper scale, which is a series of shades and colors printed on paper with the names of the tools whose temper is indicated by the color given opposite to it. A fac-simile of flat polished tool steel with colors in order from a light straw to a blue. *A.*—You will find such a scale in the second volume of Appleton's Cyclopedia of Applied Mechanics. We do not know whether such scales are printed and sold separately.

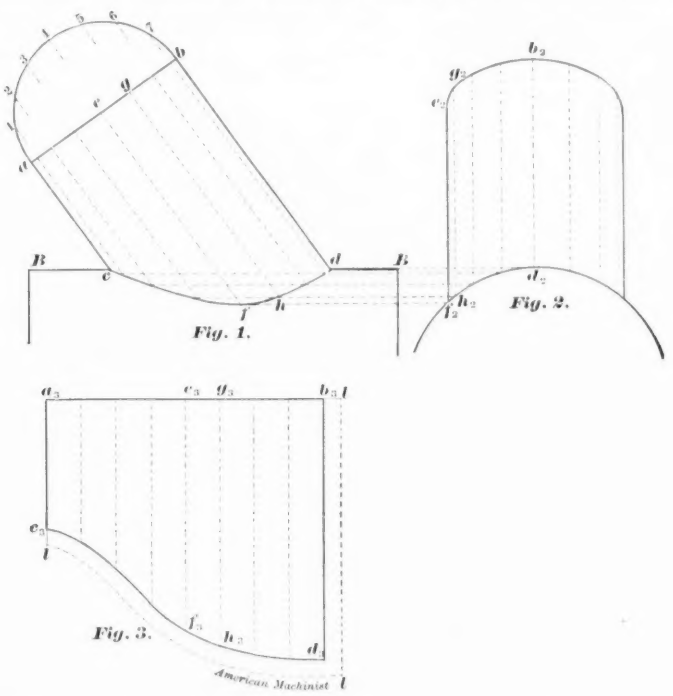
(325) C. M., Newark, N. J., writes: Kindly give me the ingredients of a suitable paint for a blackboard, and the proportions of the same. *A.*—Give the board a coat of ordinary black paint that will dry with a gloss; then apply a coat of black paint mixed with turpentine instead of oil, which will dry a dead black. These you can get mixed ready for use in any ordinary paint store. Another way is to use pulverized slate or quartz rock moistened to the consistency of a thick fluid with silicate of soda, and applied to the board with a brush; this will give a good imitation of slate, and is said to last a long while.

(326) S. T. W., Baltimore, Md, writes: The following question has been brought up: A countershaft has two pulleys on it; one is 24x6 inches, the other 38x6 inches. A belt from the main shaft drives the 24x6; the other one drives the machine; both pulleys are fastened by set-screws equally tight. Now power being applied, which pulley will turn on the shaft first? *A.*—The power transmitted by one pulley is equal to that transmitted by the other, and since the shaft is of the same diameter throughout, the tendency to turn on the shaft will be the same for both, provided friction is neglected; if this is taken into account the small pulley should slip first, because it has then more work to do. But this may again be changed by the sag or tightness of the belts, which we have not taken into account.

(327) R., Chicago, Ill., writes: Kindly answer through your columns the following questions: Lap of valve, 1 inch; throw of the eccentric, 5 inches; travel of valve, 6 inches; lower rocker arm, 10 inches; upper arm, 12 inches; $\frac{1}{32}$ inch lead; stroke of piston, 24 inches. At what part of the stroke will steam be cut off, engine working in full gear? *A.*—At 21 inches. 2. How can I obtain the length of reach rod according to shop practice, when the forward end of quadrant is lower than the back end? *A.*—Set the reverse lever parallel to the arm on the lifting shaft, and then find the length of reach rod by measurement. 3. Is there a less tedious and as certain a method of obtaining the notches on quadrant for full gear otherwise than pinching the wheels of an engine around to ascertain the full travel of valve? *A.*—We know of no other practical way. 4. When will J. G. A. Meyer's book on modern locomotive construction be published? *A.*—In a few weeks.

(328) Subscriber, Orangeburg, S. C., wishes to make a feed-water heater, and sends us a sketch and description of it, which need not be repeated here. He asks: Will it work? *A.*—No. 2. Will most of the oil be discharged through the exhaust pipe? *A.*—Yes. 3. Can I rectify the bad effects of the oil by using kerosene in the boiler? *A.*—If the oil is carefully used in the cylinders, the small amount of oil that can pass into the boilers should not give any bad effects. But if the liberal use of oil cannot be avoided we should use an oil separator. Kerosene is frequently used with good results for removing and preventing the formation of scale. 4. Can you tell me how to make a device to put on the exhaust pipe for removing the oil? *A.*—There are some very simple devices made for the purpose, but, so far as we know, they are all patented. We should certainly not attempt to make one, as it is much cheaper to buy one. 5. Will the exhaust feed water heater increase the back pressure? *A.*—Not to any appreciable extent.

(329) Y., New York, writes: I am rather confused on the following points: If steam at 100 pounds above the atmosphere is admitted into the cylinder, and cut off at .25 stroke, will not the terminal pressure be 2¼ pounds and the mean effective pressure be 59.63 pounds? Or is it proper to add to this pressure 15 pounds, and multiplying by .25 giving 28.75 absolute pressure, and 13.75 pounds above the atmosphere for the terminal pressure? *A.*—In all computations of the steam pressure in a cylinder the absolute pressures must be taken. The absolute pressure is equal to the sum of pressure as indicated by the steam gauge plus the atmospheric pressure; the latter is usually taken for the sake of simplicity at 15 pounds per square inch in computations of this kind; for very exact computations the atmospheric pressure must be determined by the readings of the barometer. At or near the sea level the average reading is 30 inches, and this indicates at common temperatures an atmospheric pressure of 14.7 pounds per square inch; this is frequently used in place of 15 pounds. If we adopt the latter figure the absolute initial pressure in your case will be 100 + 15 = 115 pounds. The absolute terminal pressure will be $\frac{115}{4}$ = 28.75 pounds, or 28.75 − 15 = 13.75 pounds as indicated by the gauge. The mean pressure is found as follows: The ratio of expansion in your case is 4; the hyperbolic logarithm of 4 is 1.386; add 1 to this and thus obtain 2.386; multiply this by the absolute steam, 2.386 × 115 = 274.39; divide this product by the ratio of expansion $\frac{274.39}{4}$ = 68.59 pounds for the mean pressure in pounds per square inch of steam of 115 pounds absolute pressure cut off at one-quarter stroke. If now the absolute back pressure is 17 pounds, then the mean effective pressure will be 68.59 − 17 = 51.59 pounds.



(330) R. T. C., New York, asks: Which is the best book of general reference for use in the drawing room—one of practical character and as free as possible from abstruse calculation? *A.*—That depends on the character of the work done in the drawing room; for marine work you should have books treating on that class of work; or for locomotive work, books treating on that and kindred subjects; the same remarks apply to other branches. Our experience has been that a draftsman has not much time to use books in the drawing office, excepting those which contain tables, and concise rules required in the engineering profession, for refreshing the memory. A draftsman, worthy of the name, knows his business, which he has learnt by practical experience, close and attentive study in his well-stocked library at home. You must not expect to design machinery from rules given in one or two books as you would play a tune from notes. You can only learn this profession by years of practice, toil and study, and careful observation. Any of the books mentioned in the article relating to "What and How to Study" in our issue of February 19, 1891, are not only adapted to study, but will also serve well as books of reference after they have been studied. 2. The articles to which you refer have not yet been completed.

(331) R. M., Newark, N. J., writes: The following subject is of vital importance to me; I have not seen it in your publication, to my knowledge. I am putting in a boiler, and my employers want a 12 inch wrought-iron pipe flanged to the boiler in addition to manhole and dome, and they want it to lead from the boiler at an angle of 45 degrees to make a connection, and I do not know how to lay it out on the sheet before cutting it; they would not like me to spoil it, as it would mean money to them, and may be more to me. Please inform me how to lay it out on the sheet before cutting. I can lay out a dome sheet, but this puzzles me. *A.*—The same principles are involved in laying out this pipe as a dome sheet, and if you can lay out the latter you should have no trouble to lay out the former. Make a drawing of the pipe and top of boiler *B B*, full size on a blackboard, as shown in Fig. 1; the line *a e* must, of course, make the required angle with *B B*. Draw any line *a b* perpendicular to center line of pipe; on *a b* as a diameter equal to the mean diameter of the pipe draw the semi circle *a* 4 *b* and divide it, say into 8 equal parts; through the points of division 1, 2, 3 etc., draw lines parallel to *a e*. Draw an end view of top of boiler and pipe as shown in Fig. 2, and draw the lines as g_2 h_2, b_2 d_2, etc., at the same distance from the outside of pipe as that of the dotted lines on the pipe in Fig. 1. Caution: This will be correct only when the semi-circle *a* 4 *b* is divided into an even number of equal parts. To understand what these lines mean, assume that the whole has been fitted up and chalk lines drawn upon the pipe as indicated by the dotted lines, then *e f* in Fig. 1 and e_2 f_2 in Fig. 2 will represent one and the same line; *g h* and g_2 h_2 will represent another one and the same line, and so on; for the sake of clearness we have used similar letters to denote the same lines. Now in Fig 2 the lines $e_2 f_2$, g_2 h_2, etc., are seen to terminate in the circumference of the boiler. Through the point f_2 draw a horizontal line meeting *e f* in the point *f*; again through the point h_2 draw a horizontal line meeting *g h* in the point *h*; and so on, thereby obtaining a number of points, which will lie in the curve *e f d*, showing the intersection of pipe and boiler. In Fig. 1 we now see the correct length of lines from the plane *a b*, and these transferred to the sheet will give its shape to which it must be cut before it is bent. Thus, in Fig. 3, which shows one-half the sheet, draw the horizontal line a_3, b_3, and make its length equal to the semi-circumference *a* 4 *b*; divide this line into eight equal parts, and through the points of division, and the extremities a_3, b_3, draw lines perpendicular to a_3 b_3. Make a_3 $c_3 = a$ *c*; b_3 $d_3 = b$ *d*; e_3 $f_3 = e$ *f*; g_3 $h_3 = g$ *h*, and so on. Through the points e_3, f_3, h_3, d_3 draw a curve; then a_3 b_3 c_3 h_3 will be the development of the sheet, without any allowance for lap. To this add the required amount of lap as indicated by the lines *l l l*. If Fig. 3 has been drawn on the sheet, then cut to these lines. It should always be understood that *a b* must be the mean diameter of the pipe; that is, from center to center of metal. It will be seen that this construction is precisely like that of laying out a dome which is square with the top of boiler; the only difference is that in the latter the lines such as *a e*, *e f*, etc., are drawn perpendicular to the top of boiler, and in the construction before us they are drawn to a given angle.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant Gear Wheels, Gear Cutting, page 20.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Ideal Drawing Stands. M. C. Hammett, Troy, N.Y.

A. D. Pentz, Consulting. Tools. Elizabeth, N. J.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

S. A. Smith, 23 S. Canal St., Chicago, Ill., is agent for Holbrook's new loaded rawhide mallets.

Automatic Gear Cutters. Best in the market. Superior Machine Works, 106 Canal St., Cleve'd, O.

Pulley lathes, most efficient offered. Ohio Machine Tool Works, Cincinnati, O.

J. S. Thurman, M. E., Indianapolis, Ind., Expert Patent Solicitor. Inventions Perfected.

Corres. with parties having special mach'y to build. Kollmyer & Talbot, Keokuk, Iowa.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Most sensitive and durable Damper Regulator made; works within one pound. Send for circular. T. Kieley, 11 W. Thirteenth Street, New York.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., cor. Canal and Washington Sts., Chicago, Ill.

Patterson, Gottfried & Hunter, Limited, 146-150 Centre st., New York, are putting on the market a new alarm speed indicator. Send for circulars.

25", 32", 37", 42" — "Only Drill Press built on 'Ko-rekt' principles, Even if they come from Jersey." Gould & Eberhardt, Newark, N. J.

S. W. Card & Co., Mansfield, Mass., are putting on the market a new line of stocks and dies, with their patent adjustable dies and guide. S. A. Smith, 23 S. Canal Street, Chicago, Ill., Western Agent.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases,
31 Nassau Street, New York.
Send for Brief History of Patent Legislation.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING CO., 205 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

"The Sun 'shines for all'" but then so does a bootblack.—*J. C. Journal.*

Gascon Discourses Upon Some Shortcomings in Text-books—Tormenting.

BY JARNO.

"In expressing his preference for diametral pitch without telling us what it is, Professor Marks is a little tantalizing; still we can excuse him, for we can learn about it in almost any other mechanical book besides Nystrom. Some of the professor's notes suggest that it would have been more accurate to put in the title, and on the outside of the cover, the words, 'Criticised by Prof. W. D. Marks,' for he seems to have failed to distinguish between criticism and revision. In extenuation of a reviser, I should say that I fear that publishers are too often unwilling to throw out old stereotypes, and the reviser, to avoid the responsibility of questionable matter, is tempted to leave it to the 'judgment of the reader.' About half the stereotyped things that I know of, I do not like. It is to be hoped that future editions of Nystrom will have wider margins, so that frequent handling will not soil the printing.

"I said that Prof. Marks is tantalizing, but Joshua Rose is tormenting. In Modern Machine Shop Practice, Vol. II, page 261,

Mr. Rose says, 'It is to be noted that the tools for shearing and gripping are made of a special mixture of cast-iron. They are thus easy of preparation and renewal, while at the same time answering their intended purpose, as well as or better than the finest steel at less than half the cost.'

"Just here Mr. Rose has become intensely interesting. I was eager to read the next sentences, because I expected that they would tell me how to compound this special mixture. I hastened to read on, but there was nothing more about it, and a careful search through the index, as well as through the whole book, failed to enlighten me; I could not even find an address where it can be obtained. He that wants anything which is in plain sight, and cannot get it, or he that has an intense liking for somebody that cares not a rap for him, knows how tormenting Mr. Rose was to me. I do not know where I can obtain 'special mixture,' and I cannot excuse him until he tells me. If not golden, his silence is certainly most complete.

"The difficulty of obtaining cuts that correspond to the text is so great as to be a constant source of trouble to authors. It has been suggested that some of the trouble might be avoided by having engravers make oath that they have read the text, and that the cuts correspond to it. That Mr. Rose has not escaped the common fate of authors, is shown in Mechanical Drawing Self-taught, page 89, where he says that in a drawing the relative distances of surfaces from the eye can be denoted by a difference in line shading, the most remote surfaces being the most shaded; but his cut does not correspond, inasmuch as the shading of the surfaces does not correspond to their remoteness. The term self-taught may mean not taught in the book.

"A chill comes over a machinist that looks at the setting of the planer tool aprons in Modern Machine Shop Practice, Vol. I, pages 422 and 427; the aprons are not set at an angle so as to lift the tool away from the work when running back. This is somewhat remarkable, as Mr. Rose, in the previous chapter, has already given a correct cut and instructions in setting an apron. I cannot see why he should let these incorrect cuts pass on to the printer. One of my inspectors first pointed them out to me; he said they set his teeth on edge, and that such setting of an apron would soon set the tool in bad edge.

"In this work Mr. Rose devotes 86 pages to wood working and wood-working machinery, and less than half this number, or only 38 pages, to forging and to press work. I find no reference either to wire-drawing or to drawing tubes from sheet metal. An acquaintance wanted to draw copper wire to less than two one-thousandths inch diameter. In what text-book can be obtained even a hint as how to begin? I have seen a sprocket wheel blank with arms drop-forged. Where can I obtain instruction as to making drop-hammer dies?

"I have said that I cannot excuse Mr. Rose until he tells us more about 'special mixture' of cast-iron, but I can now go far toward excusing him, for I have seen his last edition of Modern Machine Shop Practice, and in it he has made me laugh. The world turns ever from tears toward laughter. We have a kindly feeling for him that makes us laugh, even though at his expense. Under one of Mr. Rose's cuts, opposite page 95, Vol. I, are the words, 'Screw Threads—Uncertainties.' The cut is of an instrument for measuring screws and threads. What connection uncertainties has with such an instrument was at once a great curiosity to me; by measuring we expect to do away with uncertainties. In vain I searched the text for explanation. Of an incongruity run riot, in a sober-going mechanical text book, Mr. Rose has reached the climax. The cut originally appeared in the AMERICAN MACHINIST, where something was said about the uncertainty of maintaining the full diameter of a sharp-threaded tap. It seems that he did not care to reprint the matter relating to uncertainties, and that he failed to take the word from the plate."

Gage Lathe for Large Work.

In our issue of May 12, we illustrated and described a new Gage lathe, built by the Egan Co., of Cincinnati, O. The leading feature of this lathe, it will be remembered, consisted of a rectangular frame supporting slides in which a back knife was arranged so as to have a vertical movement, and, following the movement of the carriage, finish the work; the bits on the carriage reducing the work to fit the thimble plate, and roughing it out ready for finishing by the back knife. The design of this lathe adapts it to being constructed for work of unusually large diameter, and a larger size has now been built by the same company, which turns work up to 6″ diameter and 42″ long—much larger than we are accustomed to seeing done on Gage lathes, and, of course, giving all the advantages for this comparatively large work that are obtained by such lathes on the smaller work usually done on them.

Eccentricities of Vision.

"I do not suppose this world looks alike to any two persons," said Thomas McHenry at the Southern. "A dozen of us were looking at the moon the other night. To one it appeared the size of a five-cent piece, to another much larger than a cart wheel. To one it appeared a well-rounded globe, and to another a flat, circular piece of brass. I noticed this diversity of human vision once in Galveston, Tex. I saw a man named O'Dell shoot a fellow-gambler named Quinlan to death. He fired four shots from a large revolver. At the trial one man testified that Quinlan had a knife in his hand at the time of the shooting. Another thought it was a cane, while a third expressed the opinion that it was a billiard cue. I was standing facing him when he was shot, and would make oath that his hands were open and contained nothing. Those who testified were disinterested spectators, and told on the stand what they honestly thought they saw. The shooting began in a saloon. Quinlan ran out, followed by O'Dell, who kept shooting. Some thought one shot was fired in the saloon, others thought three, yet all were looking right at the two men. You often hear people say that what they see they know; but they don't. They have no assurance that they saw right. A man who implicitly believes his eyes is liable to fall into grievous error."—*Globe Democrat.*

Coal Must Go Higher.

It begins to look as though coals will be "black diamonds," indeed, before the year closes. This is the latest phase in the coal business: General Freight Agent Joyce, of the Pennsylvania Railroad Company, stated yesterday that the company will advance anthracite coal tolls to tidewater some time this week, but the rate has not been fixed. An officer of the road said to-day that New York will probably be paying fifty cents more per ton on or before October 10. The Reading officials are not yet prepared to say whether they will meet the advance.—*Jersey City Journal.*

A correspondent writes us that he invented a special tool for the use of machinists which was, as he calls it, "pirated" by a large concern; he asks us if the "pirating" was right. There are generally moral rights and legal rights in any question of this kind; and the legal rights are bound to prevail. It appears that our correspondent did not protect himself by a patent, and hence cannot legally complain; and moral complaint is simply a waste of time. It would be well, perhaps, if the world were run on the plane of morality, but it isn't so run, and about the only way to secure one's rights is by taking advantage of legal enactments.

Among the women who have received deserved honors during the present season is Mrs. A. E. W. Robertson, of Muscogee, Indian Territory. The University of Wooster conferred upon her the degree of Doctor of Philosophy.—*Christian at Work.*

MANUFACTURES.

The Chicago Tire and Spring Company is enlarging its plant.

A carriage hardware factory will be established at Riverton, Pa.

A machine shop will be erected at Hartsells, Ala., by Robert Sobodk.

The Boston Shoe Tool Co. are building a factory 34 by 110 feet, two stories.

The Sprenkle Pulley Company, of Pennsboro, W. Va., has been incorporated.

About $25,000 will be expended in repairs on the furnaces at Crown Point, N. Y.

M. DeBord and J. Haberlate are erecting a foundry at Huntington, W. Va.

The Jackson (Mich.) Bridge and Iron Company, capital, $100,000, has been incorporated.

The Warwood Tool Company, Wheeling, W. Va., has been organized, with $100,000 capital.

The Columbian Steam Pump Company has been organized at Chicago, Ill. Capital, $150,000.

The Rakes machine shops at Lockport, N. Y., have been sold to Edward Le Van for $4,000.

The Western Foundry Company, Chicago, Ill., will erect a frame building, 70x150 and 40x100.

The MacLaughlin Motor Company has been organized, at Chicago, Ill., with capital $1,600,000.

The Waterbury Brass Company, Conn., is erecting a new wire-mill, with a wing for wire drawing.

The Columbia Slot Machine Company has been organized, in Chicago, Ill., with a capital of $300,000.

A two-story addition, 40x75 feet, is being built to the Rodney Hunt Co.'s machine shop at Orange, Mass.

National City, Cal., has raised $70,000 of the $100,000 necessary to secure an iron plant for that place.

The Lackawanna Hardware Company, Scranton, Pa., has been organized, with a capital of $30,000.

Capitalists have organized the Montague & Lee Machine Company, at Moundville, W. Va., with $100,000.

The Bar Wheel and Foundry Company, of Chicago, Ill., has been incorporated. Capital stock, $100,000.

The Patent Steel Die Company has been incorporated, at Bridgeport, Conn., with a capital stock of $110,000.

The capital stock of the Majestic Manufacturing Company, St. Louis, Mo., has been increased from $100,000 to $200,000.

The United States Wire and Cable Company, of Schenectady, N. Y., has been incorporated, with capital of $1,000,000.

The Premier Steel Works, of Indianapolis, Ind., are building an iron building, 150x80 feet, to be used as a blooming-mill.

The Mason & Foard Company, Eddyville, Ky., are interested in the establishment of a foundry and machine shop at Princeton, Ky.

The Columbia Knife Company, Chicago, Ill., has been organized, capital stock, $50,000, to manufacture and sell knives and other edged tools.

The Russell Automatic Knife Company, Chicago, Ill., has been organized, capital stock, $250,000, to manufacture and sell knives and other edged tools.

The Atmospheric Propulsion Company, to manufacture machinery for the propulsion of wheel vehicles, has been incorporated, at Trenton, N. J.

The Southern Queen Manufacturing Company, at Chattanooga, Tenn., will increase its plant by adding an outfit for the manufacture of patent sad-irons.

A special train of thirty cars, from the harvester works of Batavia, New York, was recently chartered to take a shipment of machinery for Buenos Ayres.

The Rogers Typographic Company has been organized in Detroit, where it will erect an extensive factory for the production of type-setting machines.

The Toledo Bridge Company will build an iron bridge at Point Pleasant, Pa., to replace a wooden one destroyed by fire. The contract price is nearly $18,000.

The Automatic Rapid Lathe Company has been organized, at Saco, Maine, with a capital stock of $250,000, for the purpose of manufacturing and dealing in machinery.

The McVay Galvanized and Corrugated Steel-mill, of Chicago, Ill., is to be torn down and moved to Muncie, Ind., where it will be run in connection with the Midland Steel plant.

The Lidgerwood Mf'g Co., 96 Liberty St., N. Y., issue a new catalogue illustrating and describing their line of work in the way of hoisting and conveying machines for mining and construction work.

The Skinner Chuck Co., New Britain, Conn., have added to the capacity of the works by erecting a new building, well arranged and lighted and by putting in new and improved tools and machinery.

The Walburn-Swenson Mfg Co., successors to the Fort Scott Foundry and Machine Works Co., Fort Scott, Kan., write us that their works are to be removed to Chicago in the next two or three months.

The Holly Company, of Lockport, N. Y., has been awarded the contract to furnish Towanda, N. Y., with pumps of the most approved make, to furnish 2,000,000 gallons of water a day. They will cost about $21,000.

The West Superior Iron and Steel Company, of West Superior, Wis., have decided to use the Ridgway steam hydraulic system, and the management has placed an order for Ridgway cranes for the new hammered ingot department.

The Gaffney (S. C.) Manufacturing Co. has been chartered, to operate a cotton-mill, cottonseed-oil mill and an electric light plant. The incorporators are A. N. Wood, J. A. Carroll, H. D. Wheat and three others; capital stock, $100,000.

Hughes & Patterson, of Philadelphia, will shortly erect four rolling-mill buildings' at a cost of about $100 000. One is to be two stories in height, 40x253 feet, and the others to be one story, and 40x296, 120x155, and 75x157 feet respectively.

A new stamping factory is now assured for Bellaire, Ohio. A number of business men of the town are interested, and, although no formal application for a charter has been made, nearly all of the capital necessary has been raised.

The Baltimore (Md.) Electric Refining Co. has contracted to greatly enlarge its electric refinery at Canton. This concern employs 150 men, and refines and separates metals by electrolysis. The ores from the celebrated Anaconda copper mines are refined here.

The new universal mill which has been erected by the Pennsylvania Steel Company for the Central Iron Works, Harrisburg, Pa., is now completed, as far as the structure is concerned. The rolling machinery and necessary equipment are now being placed.

The Homer Brooke Mold Company has been incorporated, with a capital of $10,000, with place of business at Newark, N. J., and New York City, to make tools and molds for glass manufacturers. $2,000 has been paid in. Homer Brooke, Jersey City, N. J., is an incorporator.

A charter has been granted to the Rush Point (La.) Cotton Oil Manufacturing Co., having for its purpose the erection of a cottonseed-oil-mill. W. L. Dickson is president; N. W. Sentell, vice-president; J. H. Martin, secretary, and J. S. Swann, treasurer, and the capital stock $35,000.

The erection of a large foundry, to cover about an acre and a half, has just been begun by the Carnegie Steel Company, at Braddock, Pa., on the west side of Turtle Creek, near its mouth. It will make molds for the Edgar Thomson-Homestead and Duquesne Steel Works. It is expected to be finished by September; about 100 men will be employed.

The Jackson & Woodin Manufacturing Co., of Berwick, Pa., have recently put into operation an arrangement of conveyers which has inaugurated a system of continuous molding in their foundry. The arrangement consists of a sand elevator discharging into an overhead sand conveyer, which distributes the sand to the various parts of the molding floor; a flask conveyer for handling the empty flasks and molds, and upon which they are poured; and a castings conveyer, which enables the castings taken from the flask conveyer to be

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loaded onto a wagon or truck. The complete installation was furnished by The Link-Belt Engineering Co., of Philadelphia.

Machinists' Supplies and Iron.

NEW YORK, July 30, 1892.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $15 to $15.50; No. 2, $14 to $14.50; Gray Forge, $13 to $14. Southern brands of good quality are obtainable at $14.25 to $15 for No. 1 Foundry; $13.50 to $14 for No. 2; and $12.75 to $13.50 for Gray Forge.

Scotch Pig—Coltness is quoted at $21; and $20.25 for Eglington.

Antimony—The market is steady.

We quote Hallett's, 10¾c. to 11c.; Cookson's, 13¾c. to 14c.; and L. X., 12¼c. to 12½c.

Lake Copper—The market is firm, and it is reported that 11¾c. was realized for a lot of 200,000 pounds. That price will still buy, although one holder, it is said, has refused to sell for less than 12c. Car load lots of Casting Copper have sold at 10¾c. which is an exceptional price. It is held at 11c. to 11¼c.

Lead—The market is quiet and firm. There are no sellers under 4.10c. for important quantities.

Lard Oil—The market is quoted at 61c. for Prime City. Western on spot is quoted at 60c.

Tin—There are more buyers than sellers. Sales are 10 tons cash at 20.45c.; 10 tons August at 20.45c.; 10 tons October, 20.75c. The spot price is 20.50c.

Machinery—H. Bickford, Lakeport, N. H., owing to improved facilities, has reduced the prices of his 50, 60, and 72 inch boring and turning mills. New list of prices will be furnished to any one who may write for them.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. Seven words make a line, and the address as desired to appear should be included. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Position as foreman boiler maker; reference furnished. Foreman, AMERICAN MACHINIST.

Wanted—Agents in every shop for machinists' fine tools, sliding calipers, etc. E.G.Smith,Columbia, Pa.

Draftsman of 7 years' experience desires employ't in N. Y. or vicinity. Box 39, AMERICAN MACHINIST.

Junior draftsman desires position or overtime. Address C. K., AMERICAN MACHINIST.

Wanted—First-class die makers. Competent on round combination dies for tinware. Niagara Stamping and Tool Co., Buffalo, N. Y.

Wanted—Pos. by mech. draftsman, German, with theoretical education and shop practice; exp. in power transmission & gen. mach'y. P. L., Am. MACH.

Wanted—Position by draftsman who is familiar with Corliss engine work. Address Box 33, AMERICAN MACHINIST.

Position wanted by graduate of Cornell University as draftsman, 2 years' machine shop experience. Address S. C., AMERICAN MACHINIST.

Wanted—Position by a No. 1 steam engineer to erect or run steam plant; thorough mechanic; write me. Address Indicator, AMERICAN MACHINIST.

Draftsman and designer of machine tools, general and special machinery, and tools for mfrs., desires a change. Box 38, AMERICAN MACHINIST.

Situation wanted by draftsman expert in web & cylinder printing presses; A No 1 reference of 6 yrs. occupat'n in last place. Address Box 37, AM. MACH.

Educated engineer; A1 designer; excell't address; widely known; energ'c, des. selling pos'n; experi'e; convey's, tools, gen'l mach'y. Practical, AM. MACH.

Wanted—Situation as foundry foreman or superint't; 15 years' exp. on light work; married; strictly temperate; 38 years old. Box 41, AM. MACHINIST.

Mechanical eng. would represent large concerns on the road or manage N Y. office; first-class negotiator. Address Salesman, Box 3,141, N. Y.

Wanted—A man who thoroughly understands the qual of molding sand, to superintend the excavat'g & shipping; must furnish satisfact'y refs. Address, stat'g sal'y, Box 295, F. R. Bain, Poughkeepsie, N Y.

Wanted—Immediately, 1st-class planer hands on machine tool work; also 1st-class scraper, and an all around machinist. Address The Henley Machine Tool Works, Richmond, Ind.

Wanted—An exp'd man capable of filling position as superintendent in factory employing 125 hands, manufacturing electric railway supplies; must be thoroughly posted on gear-cutting and must be a hustler. Address Box 4', AMER. MACHINIST.

Wanted—At Sibley College, Cornell University, Ithaca, N. Y., several good workmen as instructors in the various shops; should be about 30, studious, skillful, interested in their work, and appreciative of the opportunities offered in residence at a great university; pay moderate, but positions otherwise attractive to the right men. Address the Director.

Wanted—First-class man, who has had long experience in Corliss engine building; must be first-class draftsman and inspector, and able to figure on compound condensing plants. Address, giving exp., ref., and salary desired, Box 28, AM. MACH.

Wanted—Superintendent for one of the largest, most progressive and best known machine tool concerns in the United States; will have entire charge of works; none need apply except those now in similar position with one of the standard tool builders of the country; must be progressive, and in touch with the most modern shop practice. For the right man this is the opportunity of his life; much more back of it than can appear in an advertisement; all communications strictly confidential. Box 31, AMERICAN MACHINIST.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d-hd lathes & planers. S. M. York, Clev'd, O.

Auto. Steam Flue Cleaners. Kelley Co., Erie, Pa.

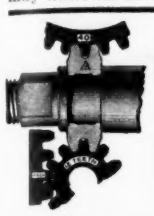
Presses, Wire Form'g Mchy. Am. Tool Wks, Clev, O.

Sliding Gauges, etc. E. G. Smith, Columbia, Pa.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Engines, special and gen. mach'y designed; ideas developed. A. W. Jacobi, 136 Liberty St., N. Y.

Special machinery designed and built. C. F. Langston & Co., 70 N. 4th St., Philadelphia.



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Combination Gear Cutters.
One pair cuts a pitch from 12 to a rack, inclusive. Of variable shape and interchangeable. These cutters are kept in stock and orders filled promptly. Special cutters and sizes made to order promptly. For descriptive circular, prices and discounts, address
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DOES STRAIGHT, CIRCULAR AND IRREGULAR WORK.
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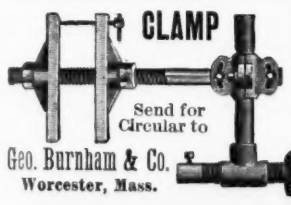

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CHICAGO COMMERCIAL COMPANY,
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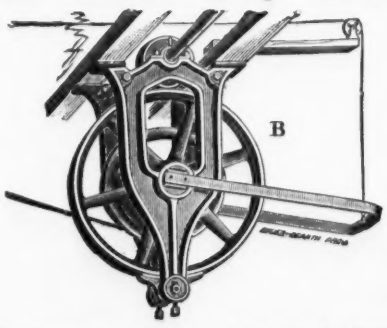
MASON'S
New Patent Whip Hoist.



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Made by VOLNEY W. MASON & CO.,
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From ⅛ oz. to 1000 lbs. Small Castings a Specialty. Light machinery wanted to build.
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ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.
For Machines or Information address the Manufacturer,
S. W. GOODYEAR, Waterbury, Ct.

WANTED
The loan of modern achievements in Castings and Founding, to be exhibited for comparison with ancient work in same line at the World's Fair by a responsible party who will give full credit and the most conspicuous exhibit possible to such articles. Castings or articles must not be bulky or weigh over 300 lbs. Best care taken of goods and returned to their owner at close of Fair.
Address EXHIBITOR, care AMERICAN MACHINIST.

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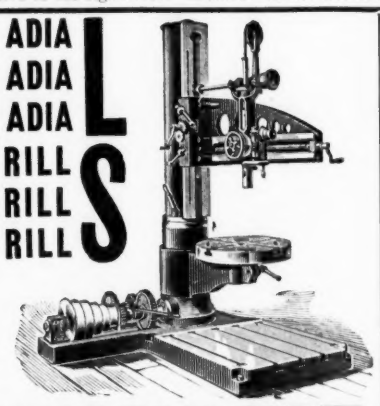

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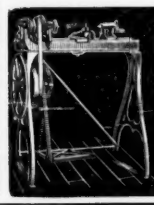

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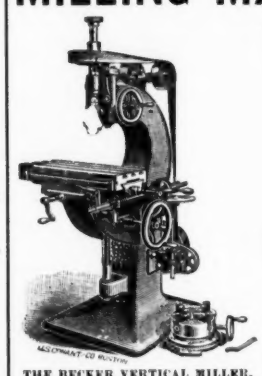

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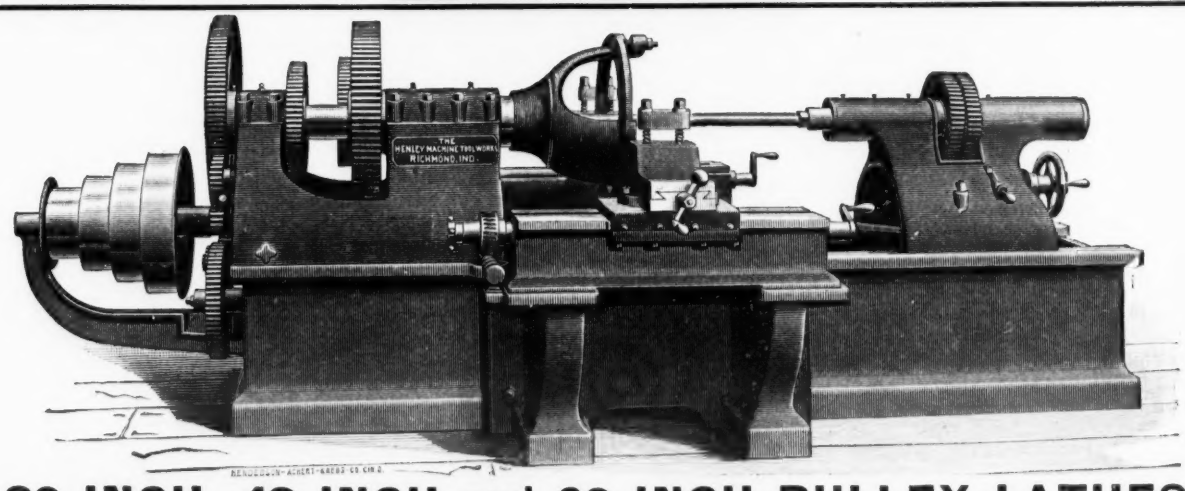
Maker of all kinds of
MACHINERY.
Special facilities for Accurate Work.
Bevel Gears cut theoretically correct.



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For Simultaneously Boring and Turning Pulleys, both straight and crowning face, Cone Pulleys, Gear Blanks, and a variety of other work. Specially adapted for turning and boring Blanks for Motor Gears.
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Makers of Implements for Standard Measurements.

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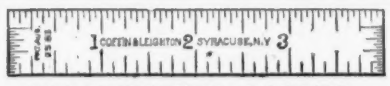

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We Invite Comparison for Accuracy with all others.
EVERY SCALE GUARANTEED. SEND FOR LIST.
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SMOOTH - COLD DRAWN
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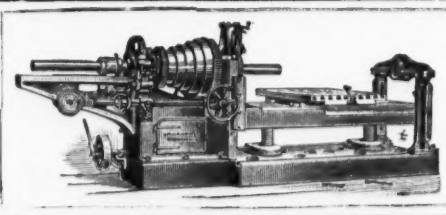

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Non-Conducting Coverings for Steam and Hot Water Pipes, Boilers, etc.
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✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

George D. Slade, dealer in molding sand of all grades, Waterford, N. Y.

For Sale, Cheap—Patent of grip pipe wrench. Address B. F. Chappell, Quarryville, Conn.

Wanted lists of fittings, etc.; specity., design & superv'n, etc., mach'y. C. Mantle, 598 E. 134th St., N.Y.

Wanted—A specialty to manufacture either heavy or light work. We have splendid facilities. Address "Manufacturers," Rockford, Ill.

Wanted—Hardware specialties to build. Send 25 cents for "Eureka Knife and Shears Sharpener." W. A. Smith & Co., 227 Eddy Street, Providence, R. I.

Wanted—To sell the entire right of my universal bench vise; best testimonials from pattern makers and others. J. F. Emmert, Box 313, Waynesboro, Pa.

Bound volumes for 1891. We are now prepared to take orders. Price, $4.00 per volume; express charges payable by purchaser. Address AMERICAN MACHINIST, 203 Broadway, New York.

We will pay 25 cents each for copies of the AMERICAN MACHINIST of December 25, 1886, issue; must be unsoiled and in good condition. AMERICAN MACHINIST PUBLISHING COMPANY, 203 Broadway, New York.

Wanted—To manufacture something in the machinery line, anything to make a business; good thing to the right party to have their work made cheap. Address Jno. E. Collins, 20 Mill street, Watertown, N. Y.

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SECOND-HAND MACHINERY.

ENGINE LATHES.

1 28 in. x 15 ft. Blaisdel, Plain Rest Raised to 36 in.	Good order.
1 28 in. x 12 ft. " Compound Rest, Raised to 40 in.	A1 condition.
1 26 in x 8 ft. Blaisdel Compound Rest Raised to 36 in.	Good order.
1 16 in x 6 ft. Hatfield, Rise & Fall Rest.	
1 15 in. x 6 ft. Blaisdel, " " " with Chuck.	A1 condition.

PLANERS.

1 22 in. x 22 in. x 5 ft. N. Y. S. E. Co.	A1 condition.
1 22 in. x 22 in. x 5 ft. Whitcomb.	Good as new.

MISCELLANEOUS.

1 Barnes Sensitive Drill Press.	Good as new.
1 Pratt & Whitney 6 Spindle Drill Press.	A1 condition.
1 Garvin No. 4-4 Spindle Drill Press.	" "
1 12 in. Gould & E. Crank Shaper.	Good as new.
1 No. 3 Cincinnati Universal Miller, complete with Rack Cutting and Vertical Attachments and lot tools.	
1 Ames Two Spindle Profiler, with Cutters.	Good order.
1 No. 3 Pratt & Whitney Plain Screw Machine.	" "
1 No. 2 " " Screw Machine, Automatic Chuck and Wire Feed.	Good as new.
1 16 in. x 8 ft. Square Arbor Fox Lathe, with Chasing Box and set of Overtail Stock.	A1 condition.
1 15 in. x 5 ft. Jones & Lamson Turret Lathe.	" "

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Second Hand and New Machinery

ON HAND.

10 ft. x 10 ft. x 16 ft. Planer.	1 Head.			
72 in. x 48 x 30 ft.	3 Heads.			
72 in. x 48 ft. x 21 ft. do	3 Heads, Detrick & Harvey, new.			
62 in. x 48 in. x 17 ft. do	1 do			
54 in. x 42 in. x 24½ ft. do	2 do			
46 in. x 33 in. x 30 ft. do	2 do			
39 in. x 36 in. x 12 ft. do	1 do			
36 in. x 38 in. x 8 ft do	Powed Al.			
30 in. x 30 in. x 7 & 8 ft. do	1 Head.			
26 in. x 26 in. x 6 ft. do	1 do			
25 in. x 24 in. x 6 ft. do	1 do			
22 in. x 21 in. x 5 ft. do	1 do			
50 in. x 30 ft. Bed Triple Geared.	New Engine Lathe,			
48 in. x 22 ft. do	do	do	do	
42 in. x 17 ft. do	Al	do	do	
36 in. x 24½ ft.	New Haven	do	do	
30 in. x 28 ft.	D. W. Pond Shafting Lathe.			
26 in. x 25 ft.	D. W. Pond Engine		do	
32 in. x 12, 14, 16, 18 ft. Bed.	New		do	do
28 in. x 12, 14, 16, 18 ft. do	do		do	do
21 in. x 10, 12 ft. do	do		do	do
20 in. x 7½ & 8 ft. do	2d Hand		do	do
18 in. x 6, 7½ & 8 ft. do	New &	do	do	do
17 in. x 8 ft.	do		do	do
16 in. x 6 & 8 ft. do	do	do	do	do
15 in. x 6 & 8 ft. do	do	do	do	do
14 in. x 6 ft. do	do	do	do	do

Car Axle Lathe, Bement.
9 & 12 in. Stroke Slotters.
15, 16, 18, 25 in. Crank Shapers.
20, 24, 26 & 30 in. Geared Shapers.
20, 22 24, 28, 30 & 36 in. Drills.
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1 Brainerd No. 3 Miller, A1.
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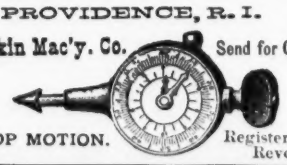

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Machine Tools in Stock.

ENGINE LATHES.

78 in. swing,	9 ft. between centers			Sellers
36 do	17 ft. bed.	New		Fifield
30 do	14 do	do		do
27 do	16 do	do		
24 do	12 do	do		Fifield
24 do	12 do	do		Fitchburg
24 do	12 do	do		Flather
22 do	10 do	New Pattern		Fifield
22 do	12 do	do		do
22 do	12 do	New		Blaisdell
21 do	8 do	do		Flather
21 do	10 do	do		do
20 do	8 do	do		do
20 do	10 do	do		do
18 do	8 do	do		do
18 do	10 do	do		do
18 do	8 do	do		Blaisdell
18 do	16 do	do		do
16 do	6 do	do		Flather
16 do	6 do	do		Blaisdell
15 do	6 do	do		Flather
14 do	6 do	do		do
14 do	6 do	do		Blaisdell
12 do	6 do	do		do

PLANERS.

42 in. wide,	42 in. high,	12 ft. long,	2 heads	Gleason
36 do	36 do	8	do	Pease
30 do	30 do	8	do	do
30 do	30 do	8	do	Whitcomb
30 do	30 do	8	do	Flather
26 do	26 do	6	do	do
24 do	24 do	6	do	do
24 do	24 do	6	do	Whitcomb
22 do	22 do	5	do	do
22 do	22 do	6	do	Flather

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12, 16, 20 and 24 inch stroke	Eberhardt
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20, 21, 25, 28, 30 and 36 inch swing	Prentice
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NEW AND SECOND HAND. (In stock.)

Engine Lathe,	13 in. x 6 ft., Hollow Spindle	Ames Mfg. Co.
" "	14 in. x 6 ft., Taper Attachment.	Hendey.
" "	14 in. x 6 ft., Compound Rest.	Fitchburg.
" "	14 in. x 6 ft., Ashton Hand.	Good order.
" "	16 in. x 6-8-10 ft., Extra Heavy.	Hendey.
" "	16 in. x 6-8 ft., New Heavy Pattern.	Fitchburg.
" "	16 in. x 6 ft., with Gdg. Att., Pond.	Good order.
" "	16 in. x 6 ft., Lathe and Morse.	" "
" "	16 in. x 6-8 ft., Special Low Price.	Standard.
" "	18 in. x 6-8-16 ft., C'p'd Rest, Taper.	Hendey.
" "	18 in. x 8-10 ft., New Heavy Pattern	Fitchburg.
" "	18 in. x 8 ft., Fair Order. Low Price.	New Haven.
" "	20 in. x 8 ft., Hollow Spin. Cross Feed.	Perkins.
	Late Pattern.	Good order.
" "	20 in. x 8-10-12-14 ft., Low Prices.	Standard.
" "	22 in. x 10 ft., C'p'd Rest.	Perkins.
" "	24 in. x 12 ft., Old Style, Low Price,	Fair order.
" "	24 in. x 12 ft., C'p'd Rest, Putnam.	Good order
" "	24 in. x 12 ft., " "	Perkins.
" "	24 in. x 12-14-16 ft., Low Price.	Standard.
" "	28 in. x 16 ft., Extra Heavy.	"
" "	32 in. x 12 ft. Low Price.	"
" "	36 in. x 14 ft., New Heavy Pattern.	Fitchburg.
" "	60 in. x 20 ft., Old Style. Fair.	Very Low Price.
" "	66 in. x 24 ft., for Facing and Boring,	" "

Planers, 24x6 8 ft., 36x8 ft., 48x10 ft., 72x12 ft.
Shapers, 6-9-15-24 and 30 in. stroke.
Upright Drills, 20-24-28-32 and 34 in. swing.
Radial " 3 4-5 and 6 ft. Arms.
Gang " 3 and 4 Spindles.
Screw Machines, 15-16, 1 3-8 and 2 1-8 in. holes.
Milling Machine, Hand, Power and Universal.
Slotting Machine, 9 in. stroke, Modern Style.
Pipe Machine, 4 in., with Dies Morris & Tasker.
Bolt Cutter, 1½ in. Sellers, Low Price.
Bradley Hammer, 60 lb Good order.
Upright Boring and Turning Mill, 38 in. swing.
Hor. Boring Mill, 40 in. x 10 ft., Nicholsen's latest.
Boiler Rolls, 6 ft., Modern, heavy and powerful.
" 8 10 ft., New Improved Patterns.
Riveting Machine, 60 in., with complete hoisting rig.

J. J. McCABE,
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Meet all requirements more fully and satisfactorily than any other of its competitors.

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INVESTIGATION IS CONVINCING.

WRITE FOR CATALOGUE TO
THE HACKNEY HAMMER CO.
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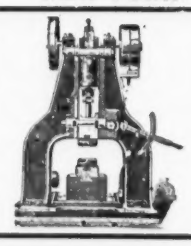

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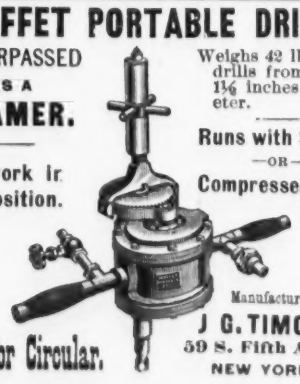

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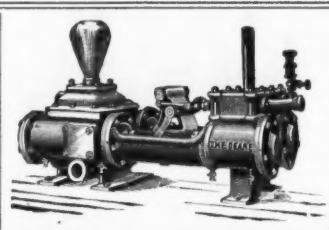

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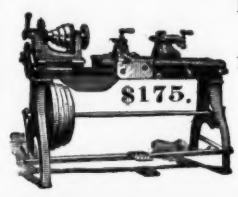

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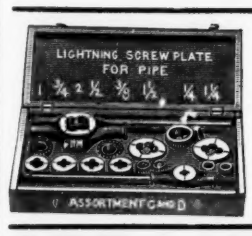

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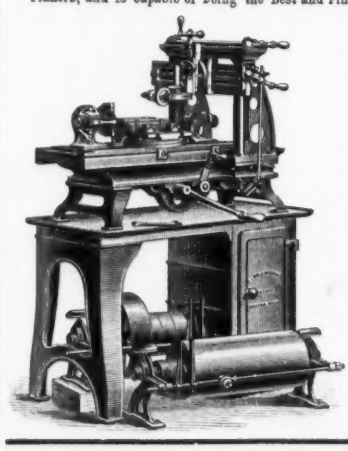

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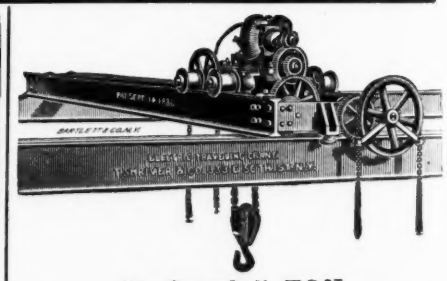

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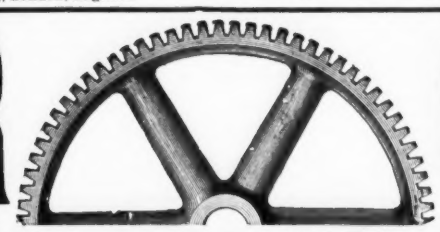

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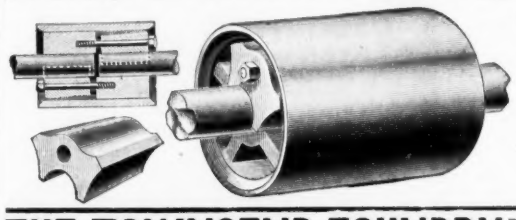

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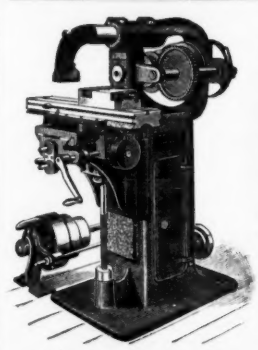

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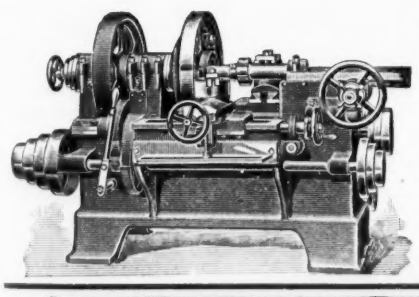

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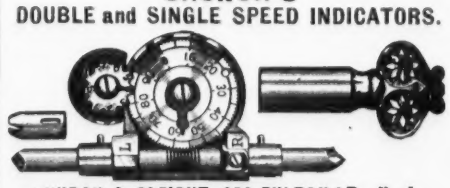

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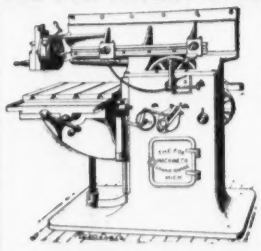

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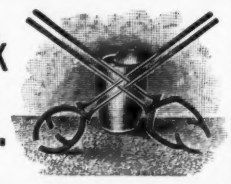

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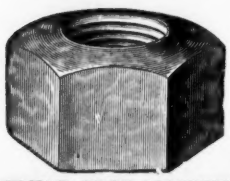

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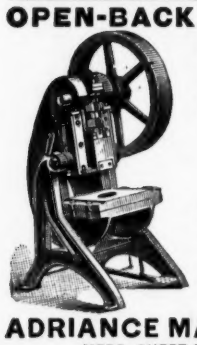

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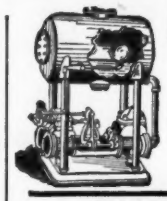

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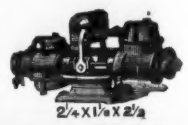

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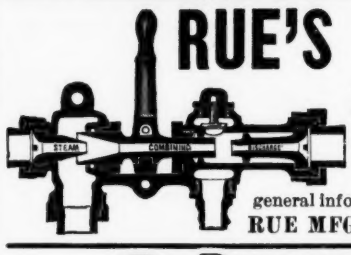

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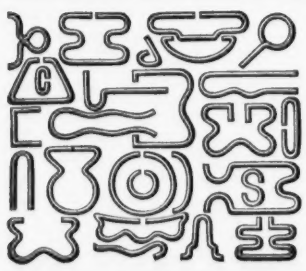

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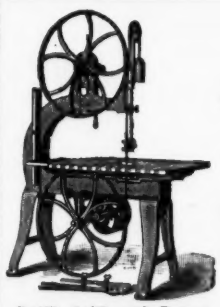

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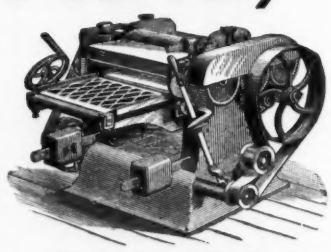

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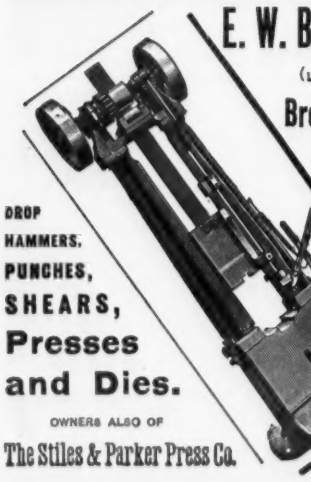

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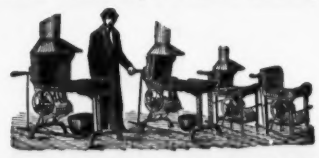

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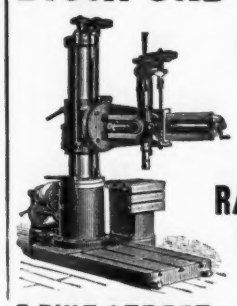

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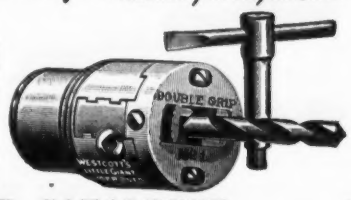

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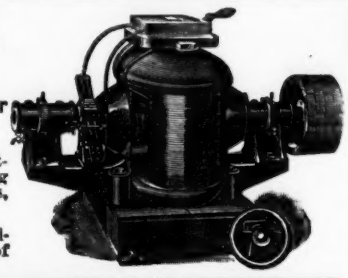

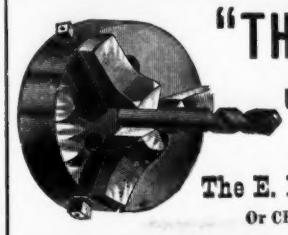

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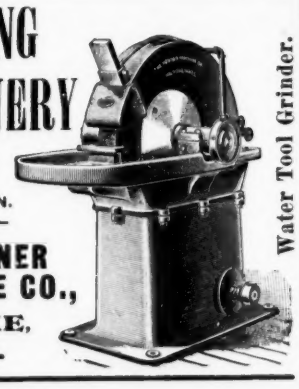

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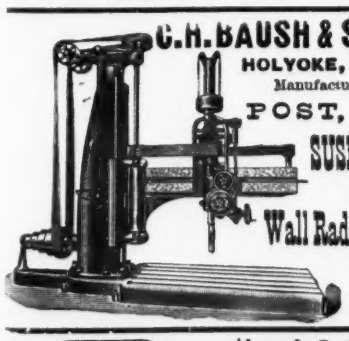

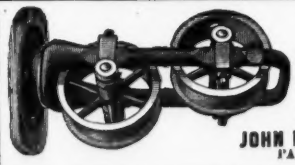

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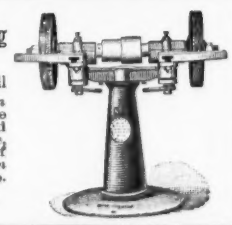

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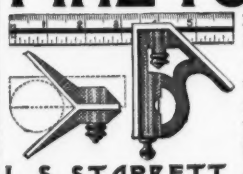

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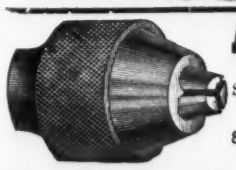

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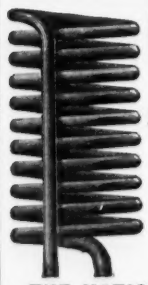

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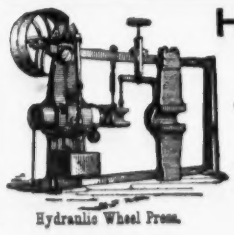

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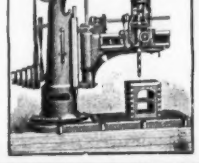

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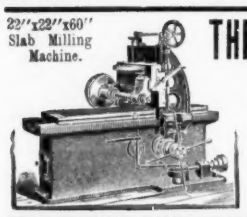

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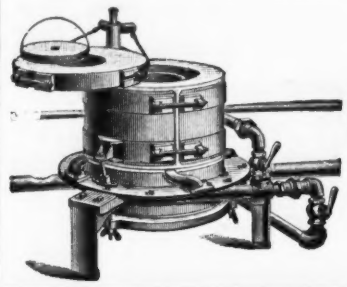

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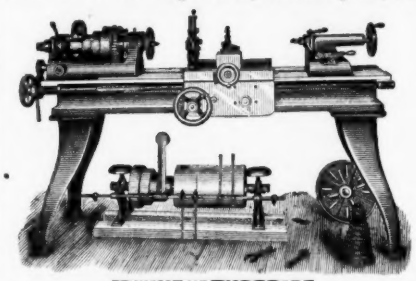

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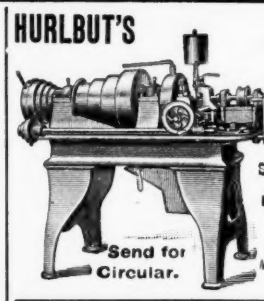

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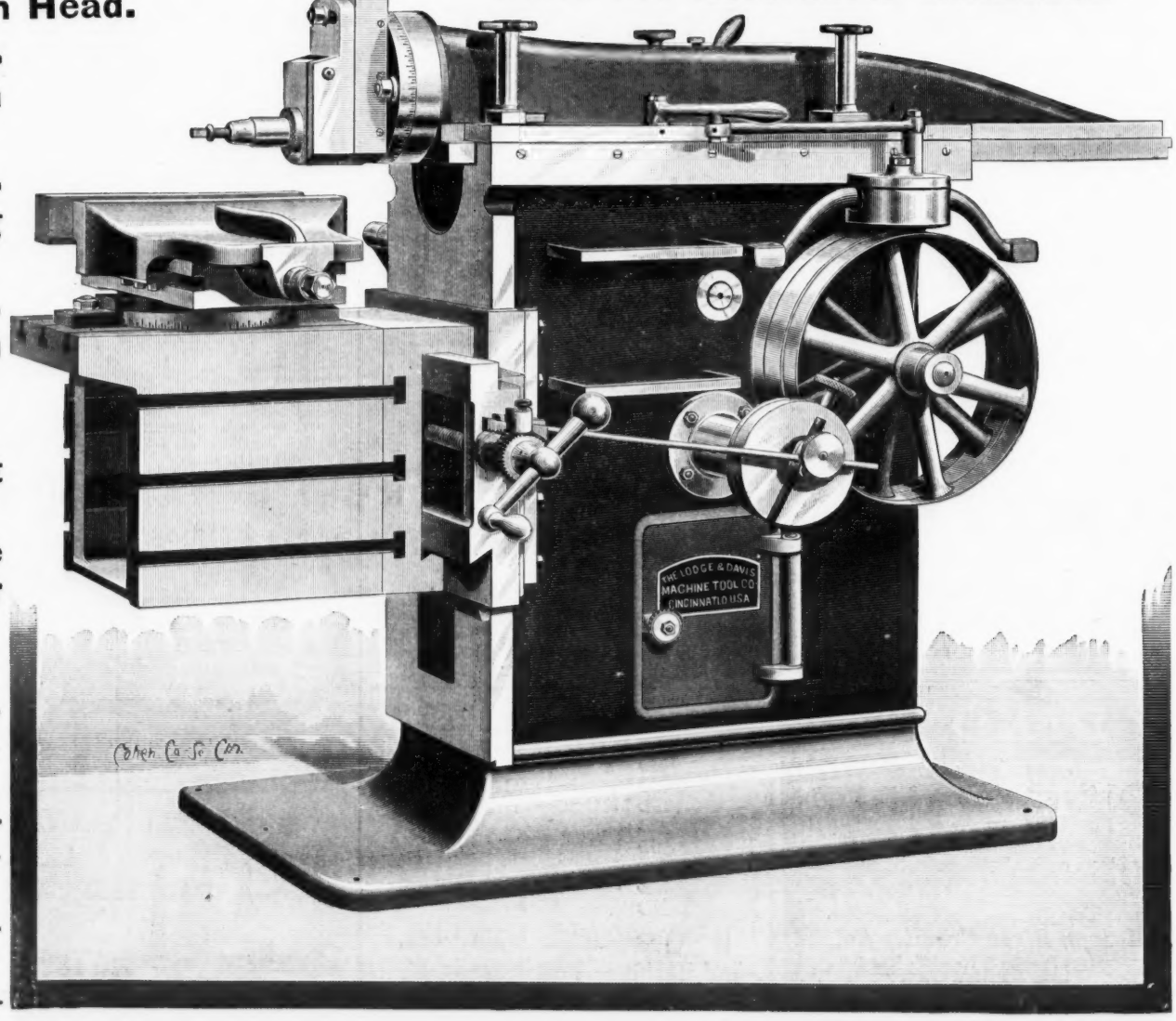

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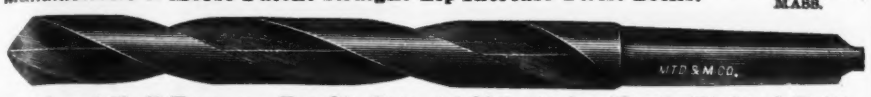

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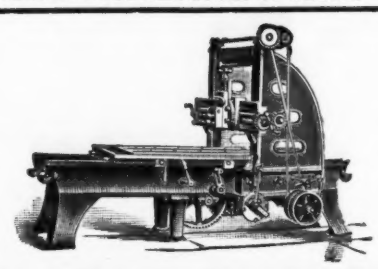

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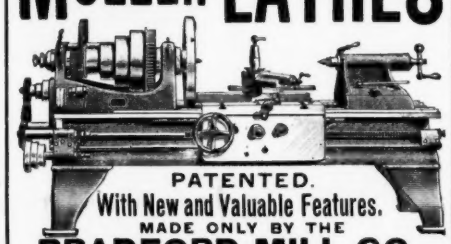

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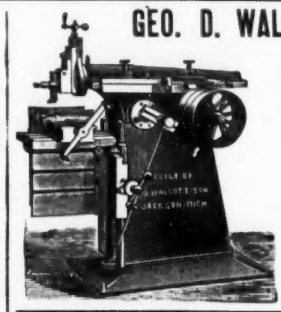

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Dear Sir:—The 28 in. Drill purchased of you three years ago, we have kept in constant use and have found it first class in every respect.
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UNION WATER METER CO.
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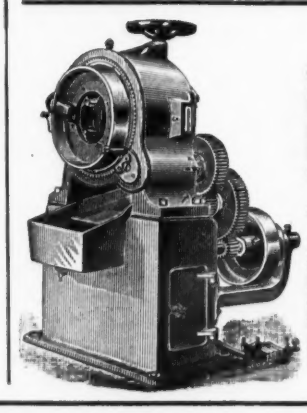

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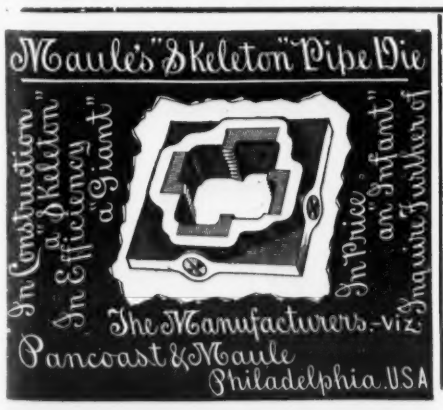

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WE WILL GUARANTEE TO
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BUILT IN 3 SIZES, 2, 4 AND 6 SPINDLE, BY
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THE LARGEST ORDER
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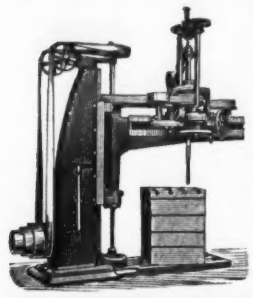
It was for 500 Locomotive Reducing Valves. What inference do you draw from this?



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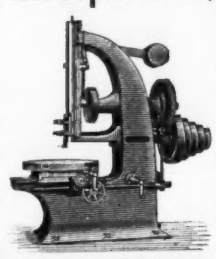

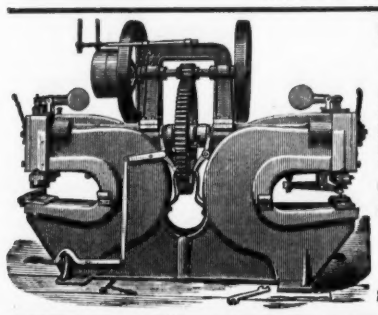

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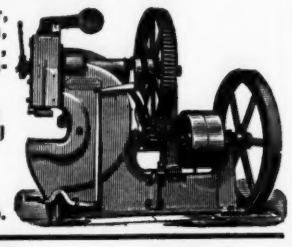


THE OPEN SIDE IRON PLANERS.

THE DETRICK & HARVEY MACHINE CO., Baltimore, Md.

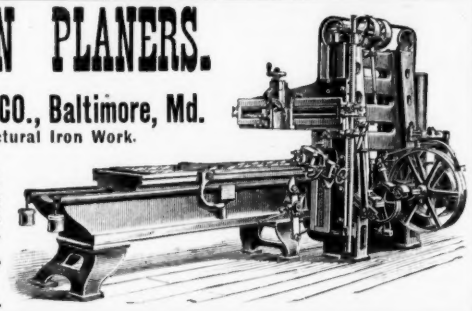
TACONY IRON & METAL CO., Architectural Iron Work.

TACONY, PHILADELPHIA, PA., Oct. 29, 1891.

GENTLEMEN: Replying to yours of the 28th inst., we would state that one of your Open Side Planers has been used by us for the last three or more years. All of our men who use it consider it a most handy tool. We use it on almost everything; planing off ends of long columns, or edging wide plates and general machine work.

We frankly say that it would be difficult for us to do without your planer. Very respectfully,

TACONY IRON & METAL CO.,
F. SCHUMANN, President.



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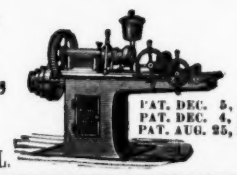
Also SEPARATE HEADS and DIES.

FIRST PREMIUM. CINCINNATI CENTENNIAL.



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CRANES, PORTABLE HOISTS, OVERHEAD TRACK TROLLEYS.

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Yours truly,
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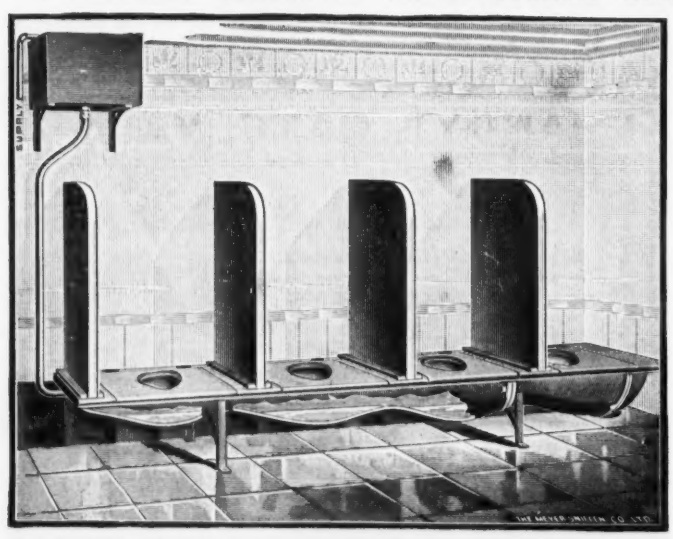

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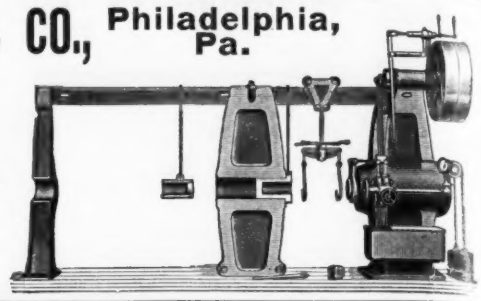

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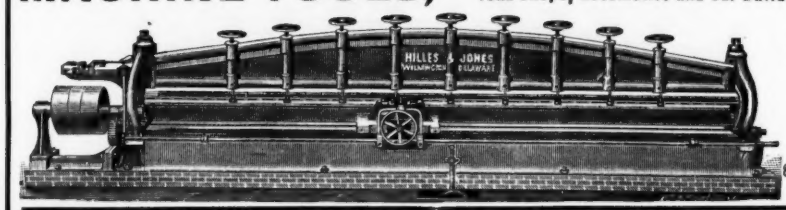

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Eight Sizes.

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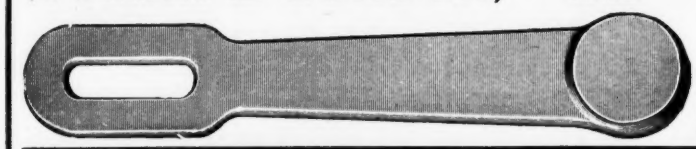

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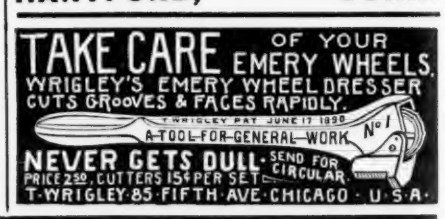

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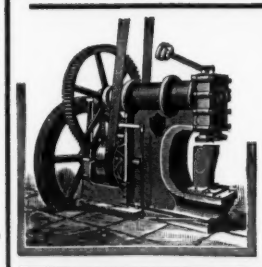

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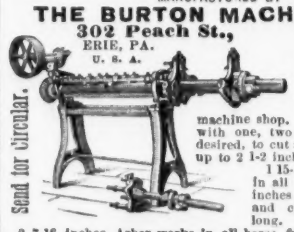

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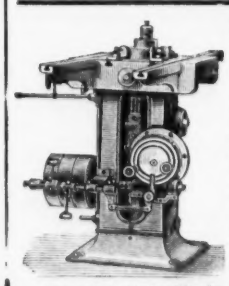
With an attachment for the purpose seats can be cut in holes as small as 1 inch diameter, by one passage of the cutter.

If the work is heavy and too large to be placed on machine it can be detached from stand and used as portable machine.



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Will cut through 4-foot hub, through 5-inch hole. Our new centering chuck and setting attachment the work can be set exactly, without the use of a scale or rule. Our new binding attachment takes the place of bolts, with a key-way and key to fit it.

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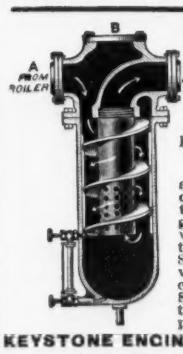

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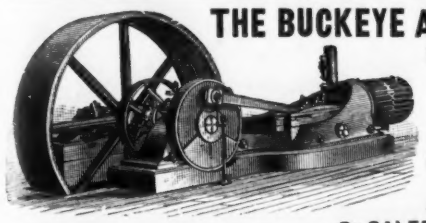

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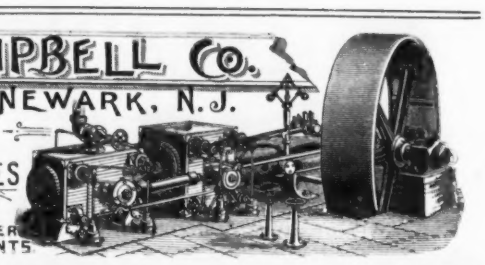

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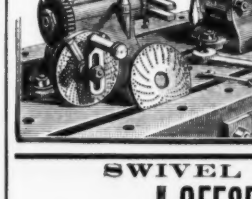

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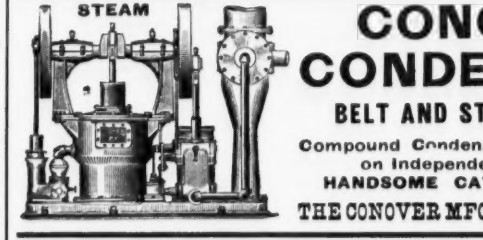

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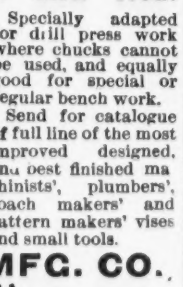

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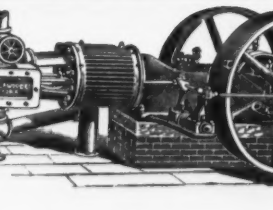

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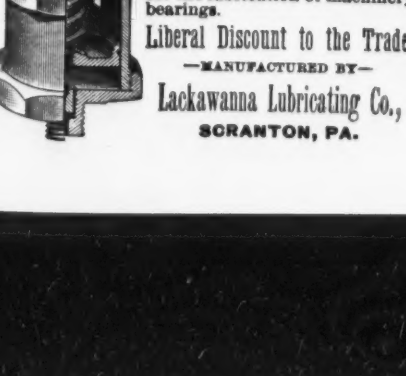

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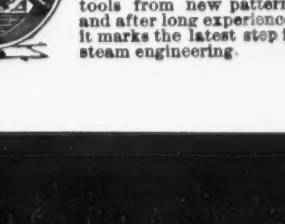

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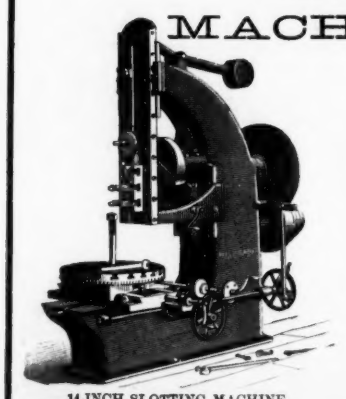

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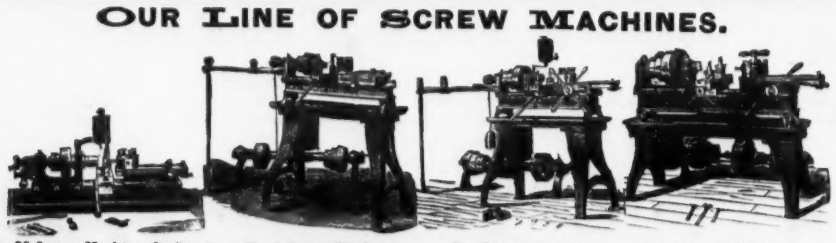

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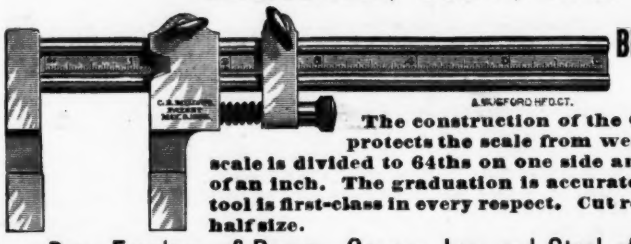

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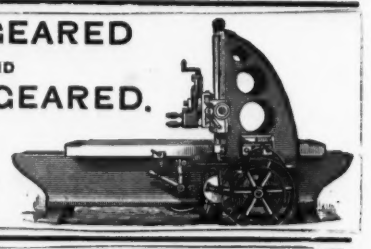

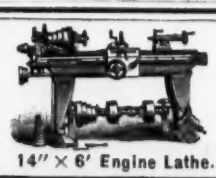

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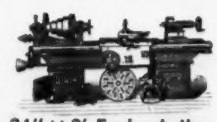

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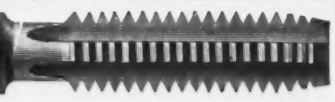

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